

State Water Resources Control Board

Workshop II: Bay-Delta Fishery Resources

- October 1, 2012 -



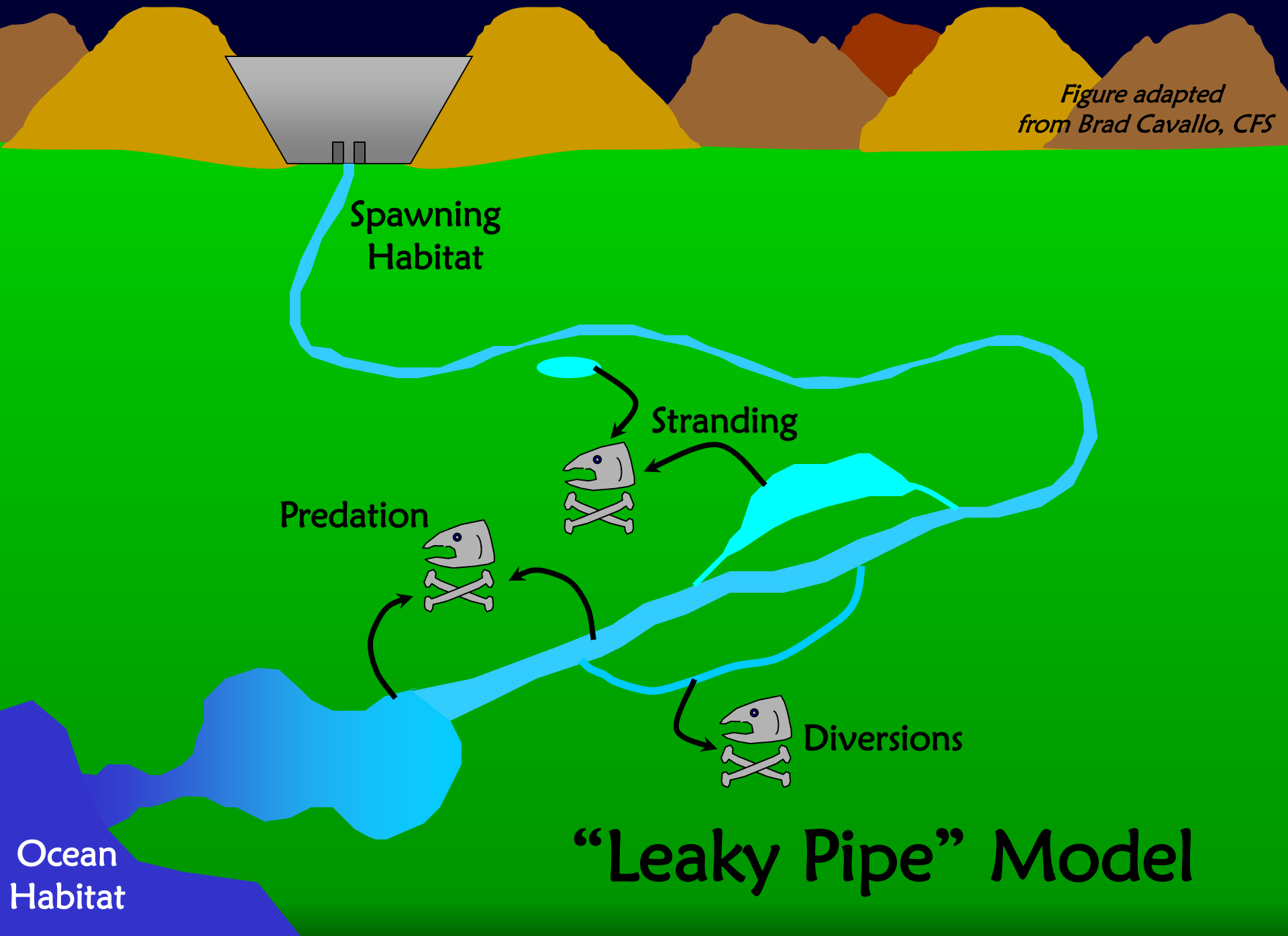
Russell Stein
Acting Deputy Director, Delta and Statewide Water Management

Brett Harvey
Division of Environmental Services, Environmental Scientist

Gardner Jones
Division of Environmental Services, Staff Environmental Scientist

Dennis McEwan
Division of Environmental Services, Environmental Program
Manager I

*Figure adapted
from Brad Cavallo, CFS*



"Leaky Pipe" Model



Hatchery
Supplementation



Fish Trucking



Gate
Closures



Export
Restrictions

Ocean
Habitat

“Leaky Pipe” Model



Improved Hatchery Management



Stream Restoration

Riparian Corridors



Brackish Marsh



Freshwater Tidal Wetlands



Seasonal Floodplain



Gate Closures



Export Restrictions

Ocean Habitat

“Bet Hedging” Model

Coded Wire Tag survival studies:

Inflow important – Export influence mixed

	<u>Inflow</u>	<u>Export</u>	<u>CWT survival study</u>
San Joaquin	✓		Baker and Morhardt 2001
	✓		CDFG 2005
	?		SJRGGA 2007
	✓		Newman 2008
	⊖		Zeug and Cavallo in review
Sacramento	✓		Kjelson and Brandes 1989
	✓		Newman and Rice 2002
	✓		Newman 2003
			Newman 2008
			Newman and Brandes 2010
	⊖		Zeug and Cavallo in review

✓ = significant effect

⊖ = no effect

? = mixed results

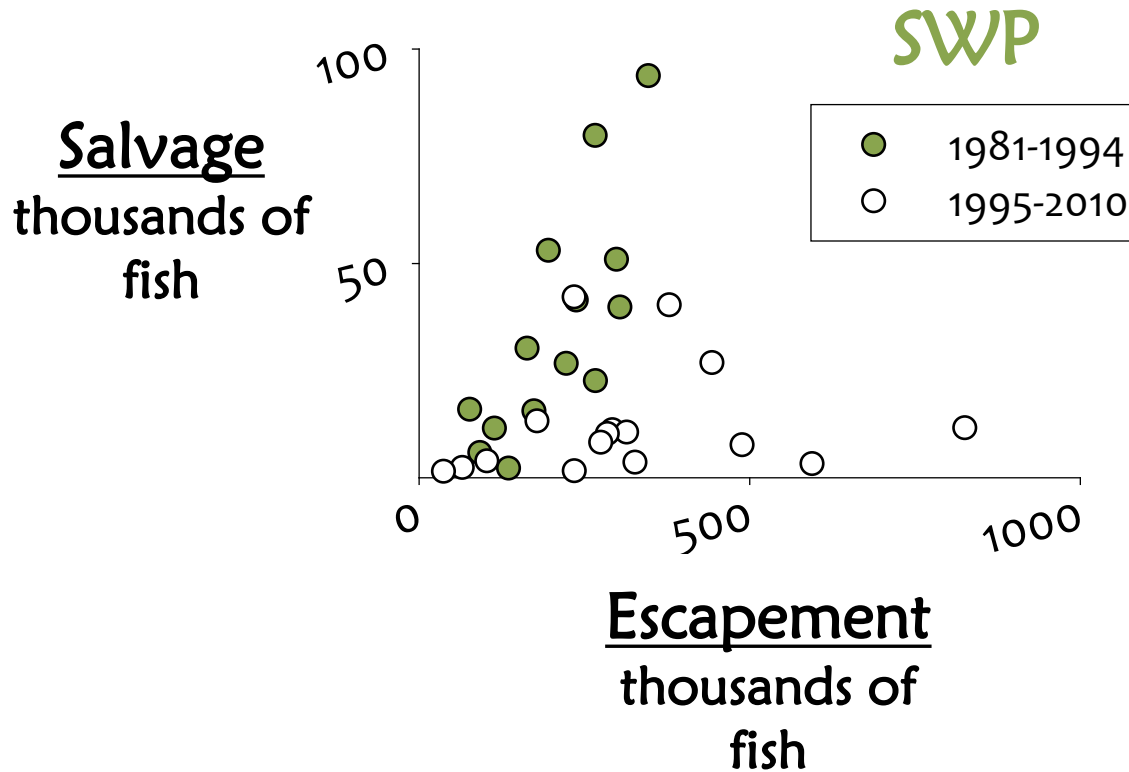
Coded Wire Tag survival studies:

Inflow important – Export influence mixed

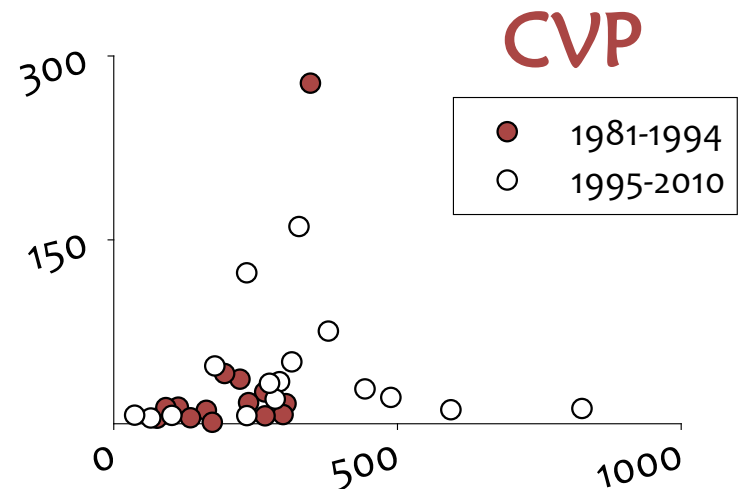
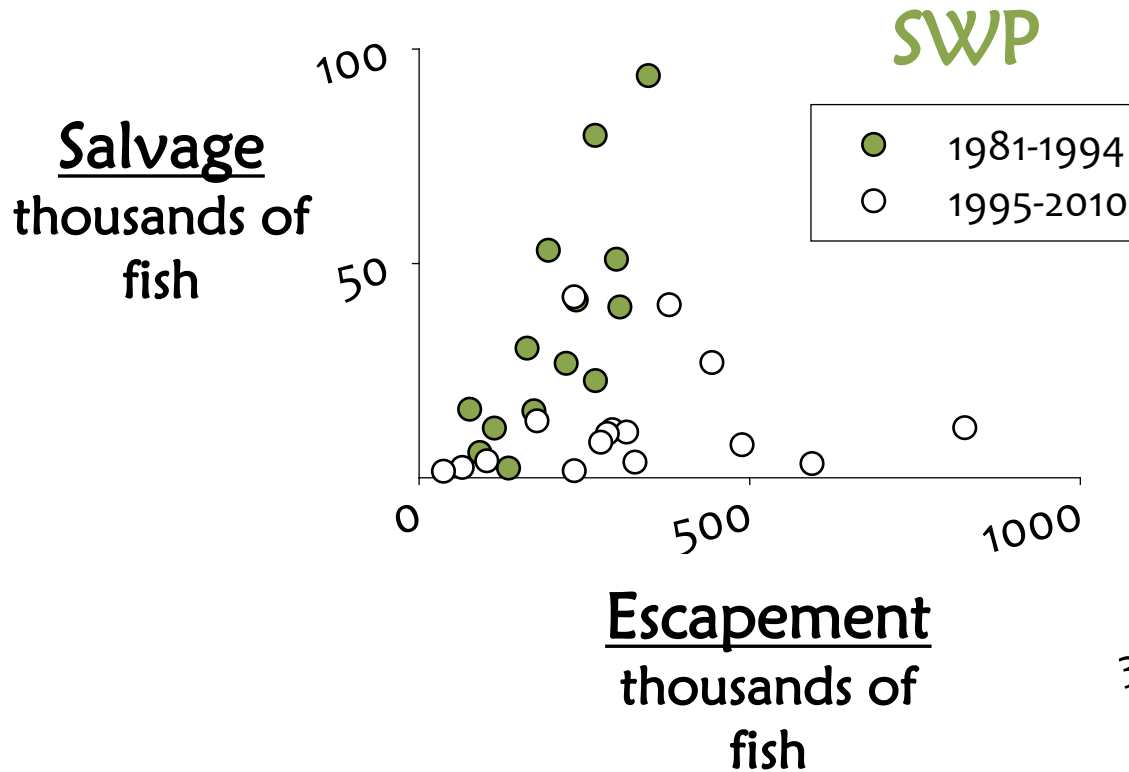
	<u>Inflow</u>	<u>Export</u>	<u>CWT survival study</u>
San Joaquin	✓	?	Baker and Morhardt 2001
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	✓	✓	Newman 2003
		?	Newman 2008
		?	Newman and Brandes 2010
	⊖	⊖	Zeug and Cavallo in review

✓ = significant effect
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Lower Salvage Rate at SWP since Bay-Delta Accord

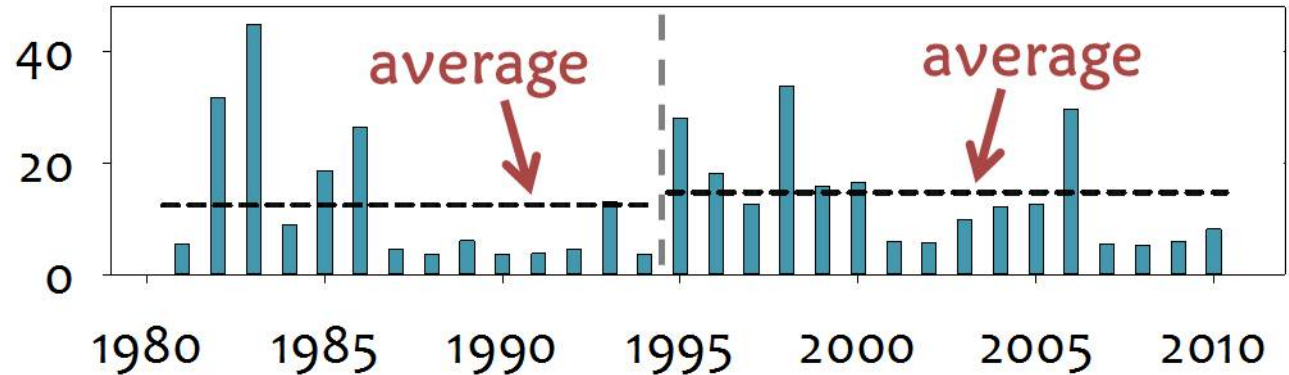


Lower Salvage Rate at SWP since Bay-Delta Accord



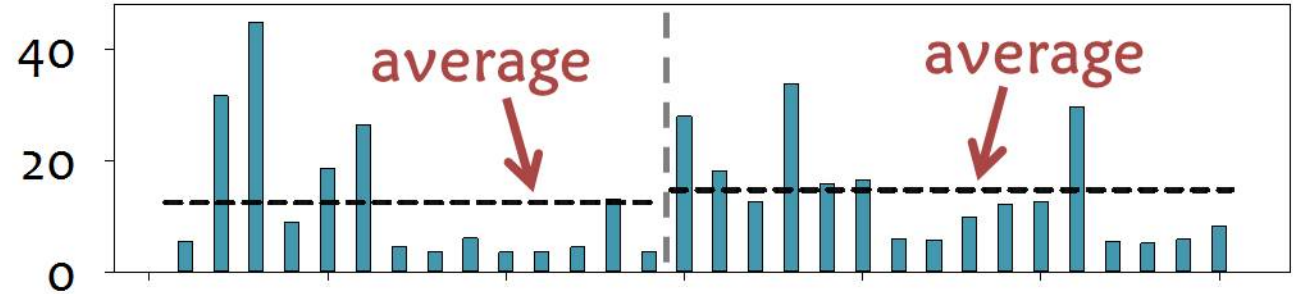
Lower February-June E:I ratio since Bay-Delta Accord

Inflow
millions acre feet

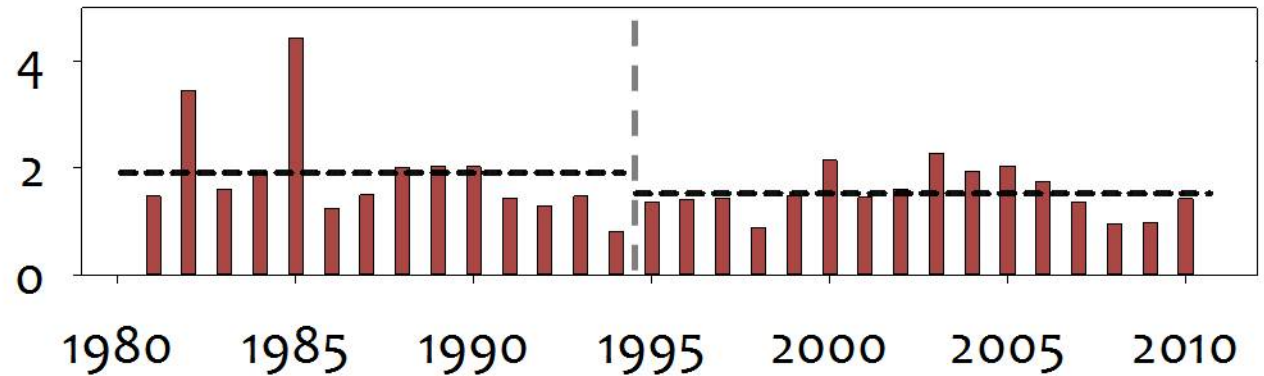


Lower February-June E:I ratio since Bay-Delta Accord

Inflow
millions acre feet

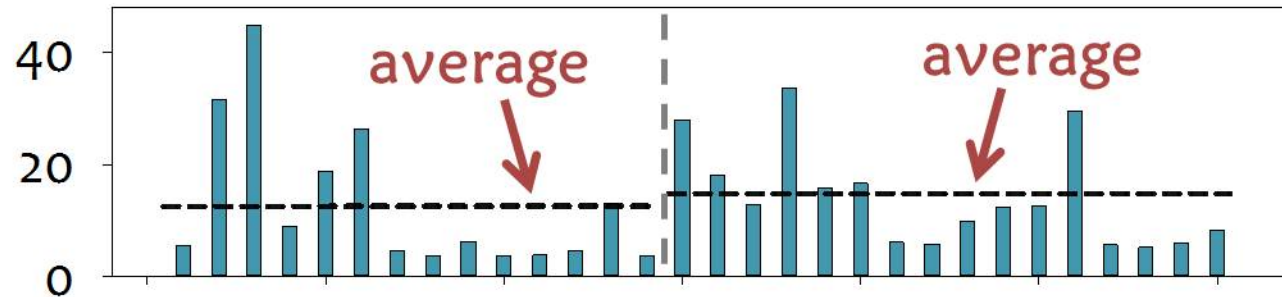


Export
millions acre feet

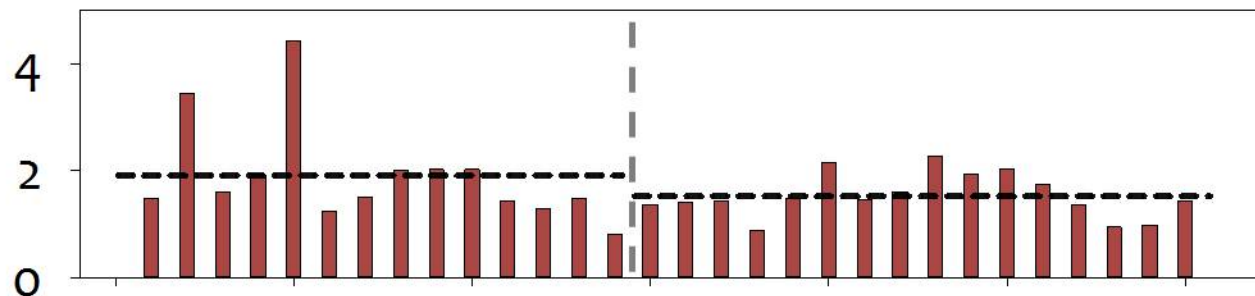


Lower February-June E:I ratio since Bay-Delta Accord

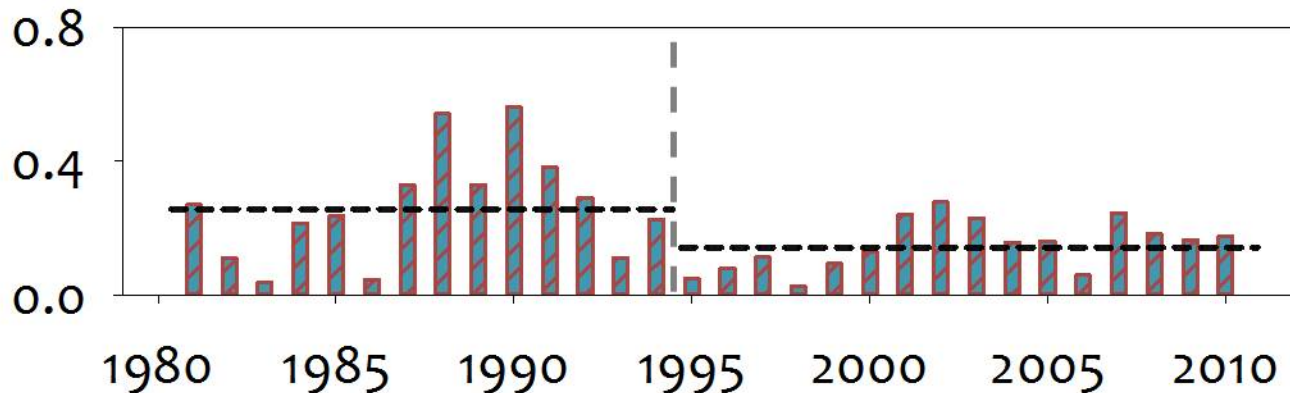
Inflow
millions acre feet



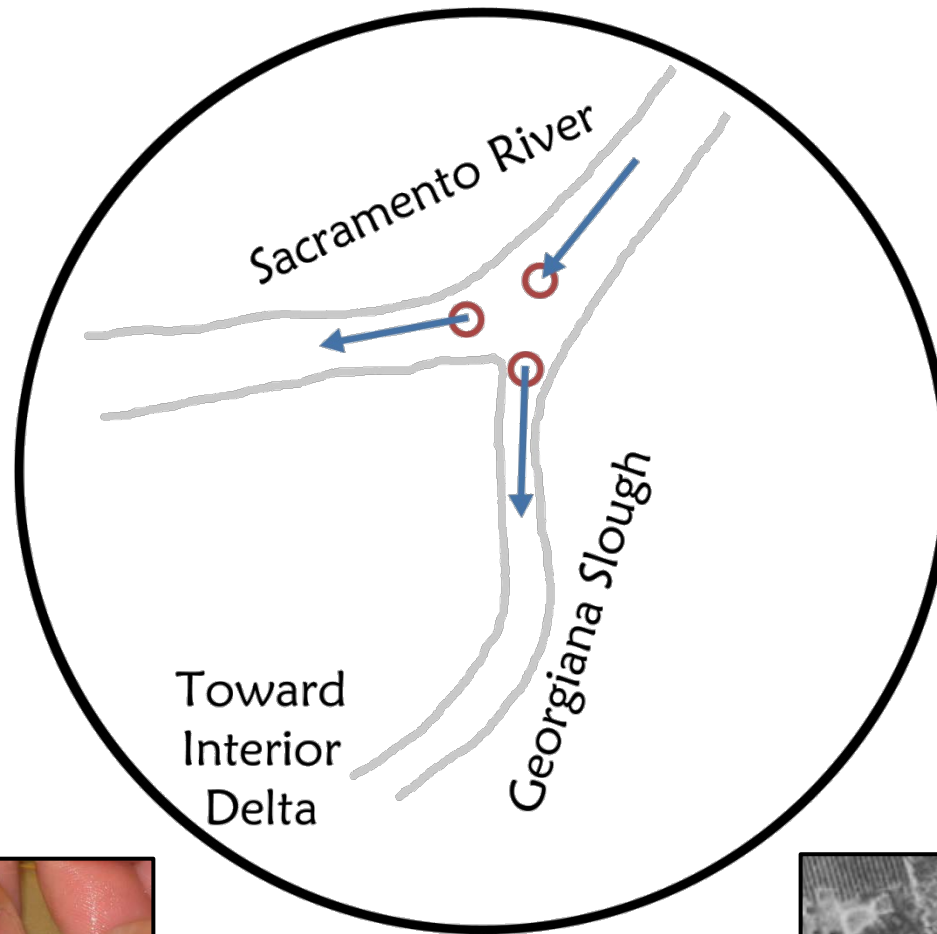
Export
millions acre feet



Export:Inflow



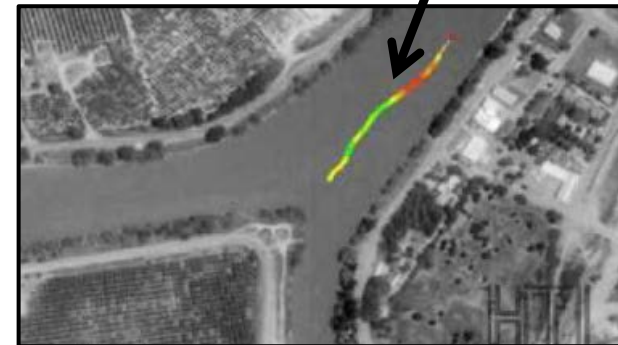
Telemetry shows juveniles “go with the flow”



telemetry
tag

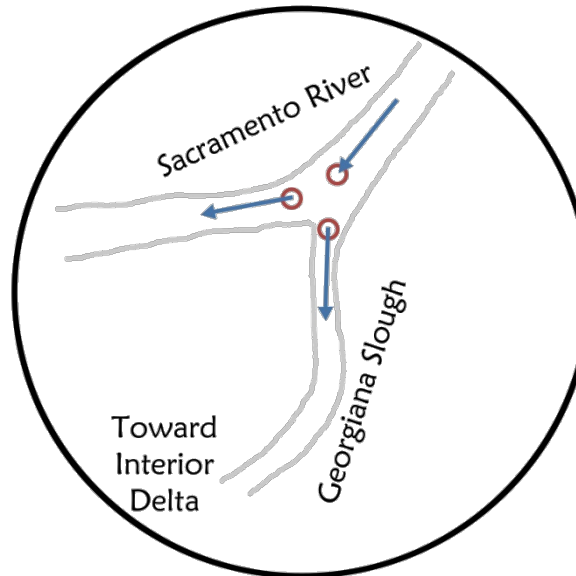
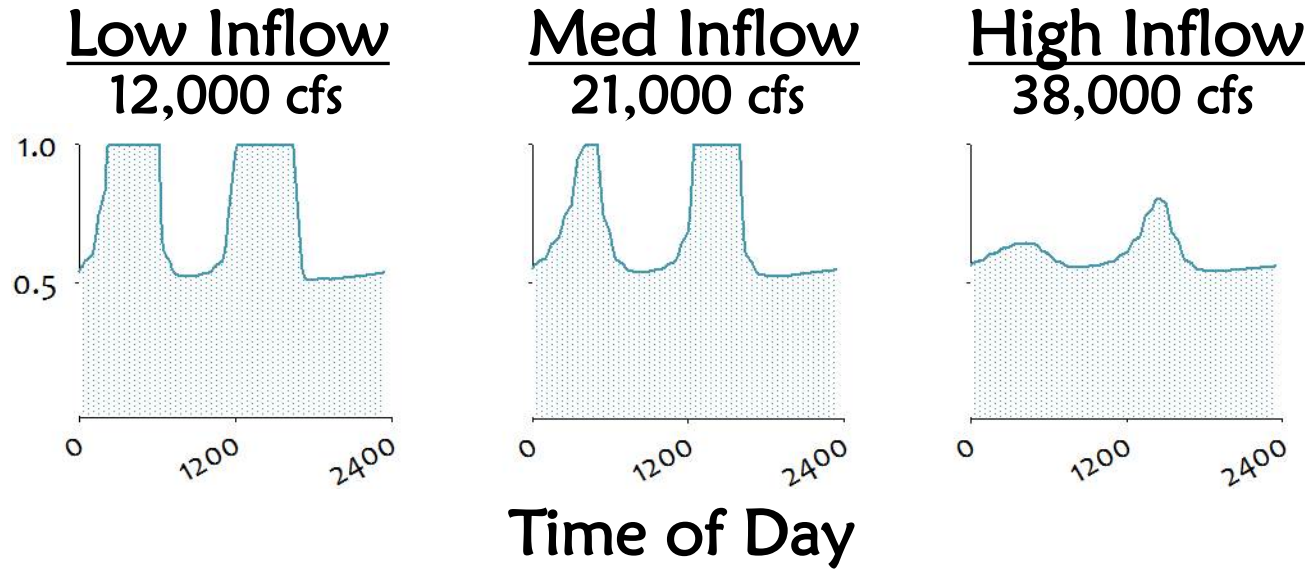


telemetry
trace

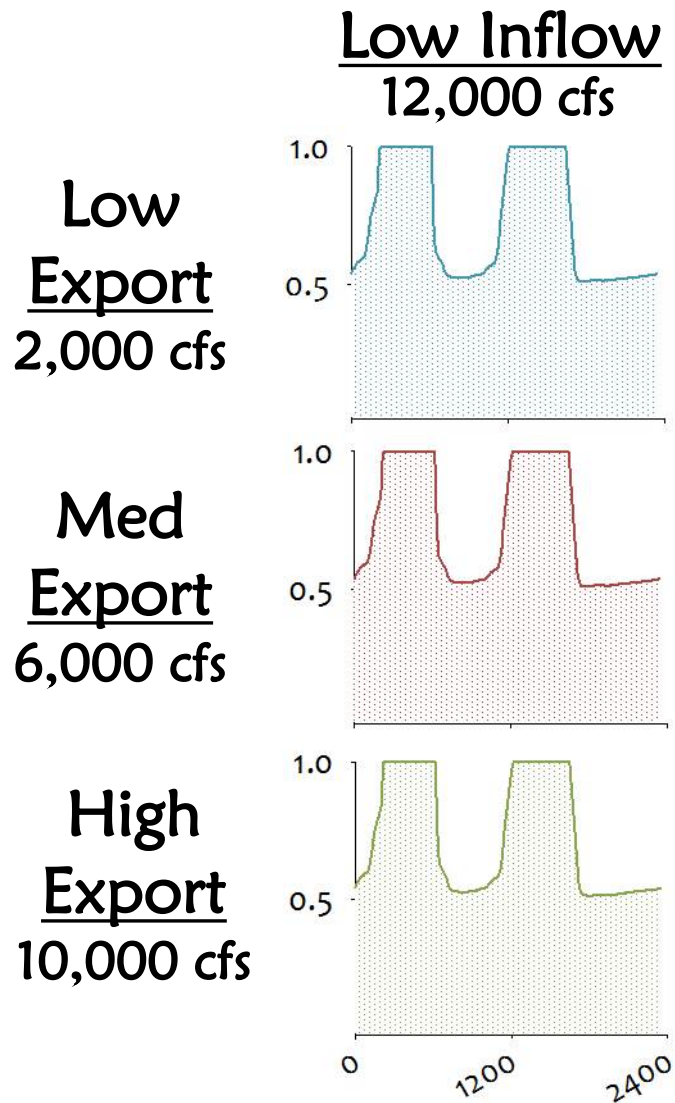


Inflow affects flow fraction into Georgiana Slough

Flow
Fraction



Exports have minimal effect on flow split



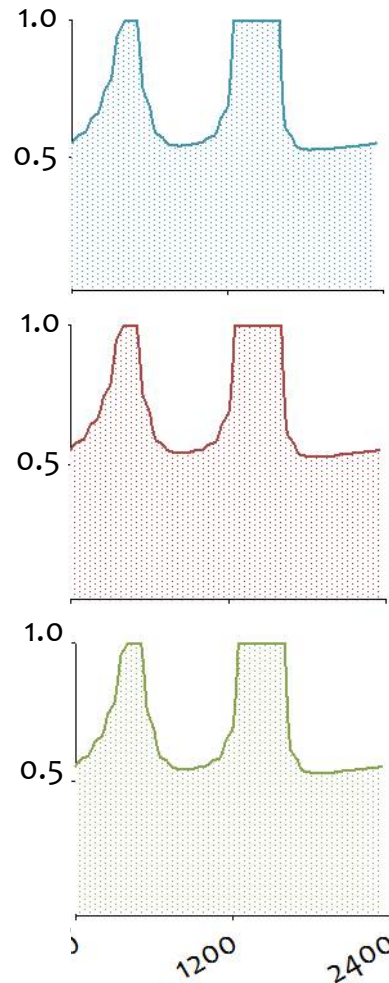
Exports have minimal effect on flow split

Low
Export
2,000 cfs

Med
Export
6,000 cfs

High
Export
10,000 cfs

Med Inflow
21,000 cfs

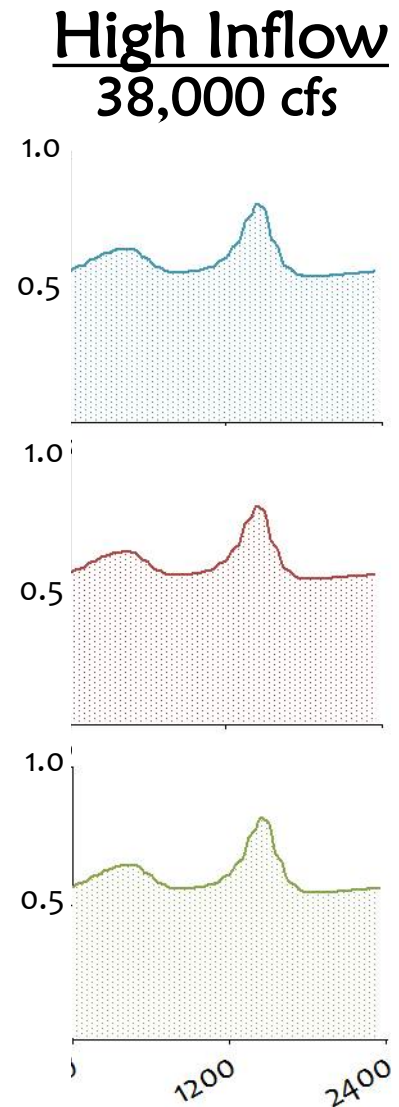


Exports have minimal effect on flow split

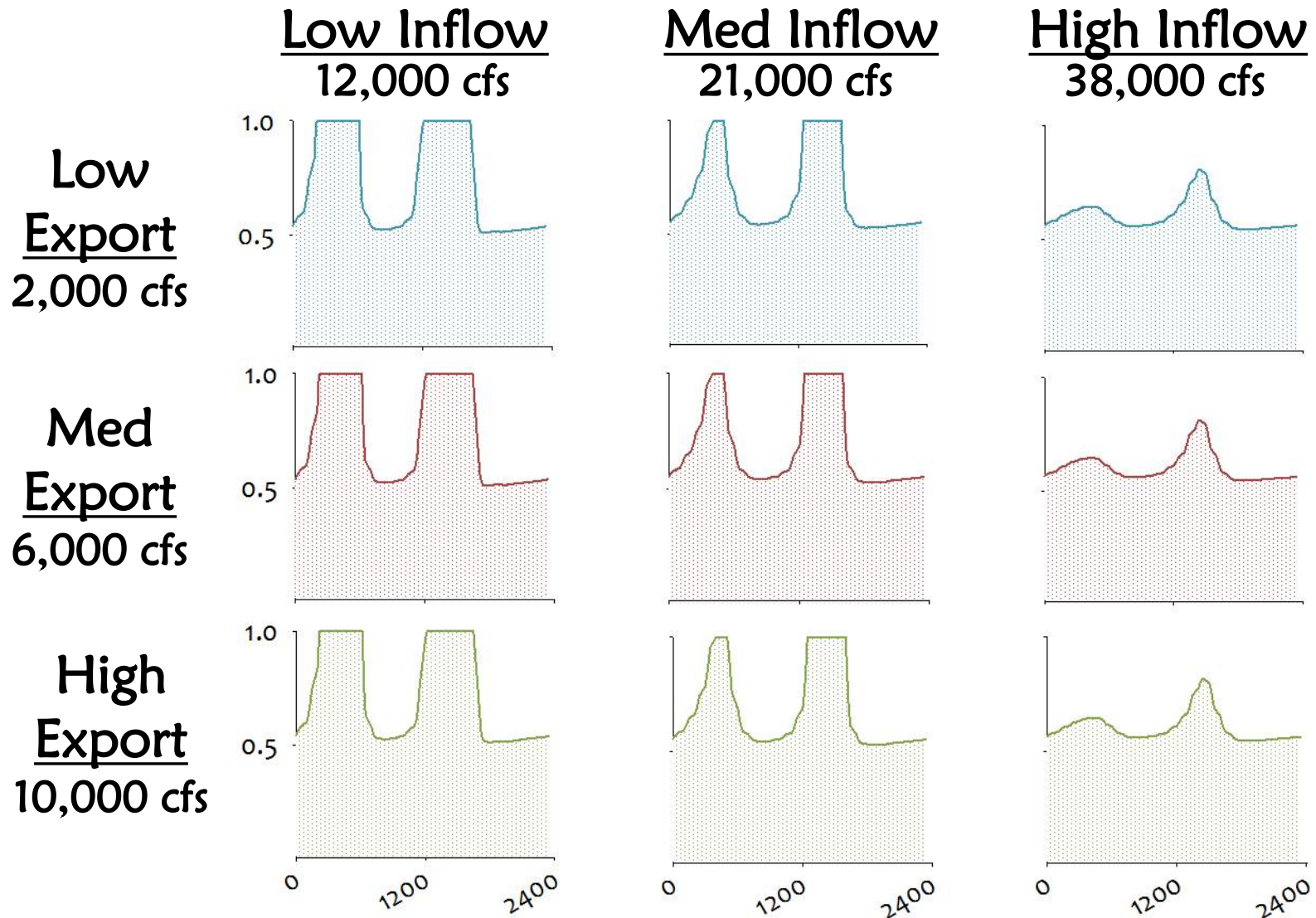
Low
Export
2,000 cfs

Med
Export
6,000 cfs

High
Export
10,000 cfs



Exports have minimal effect on flow split





Improved Hatchery Management



Stream Restoration

Riparian Corridors



Brackish Marsh



Freshwater Tidal Wetlands



Seasonal Floodplain



Gate Closures

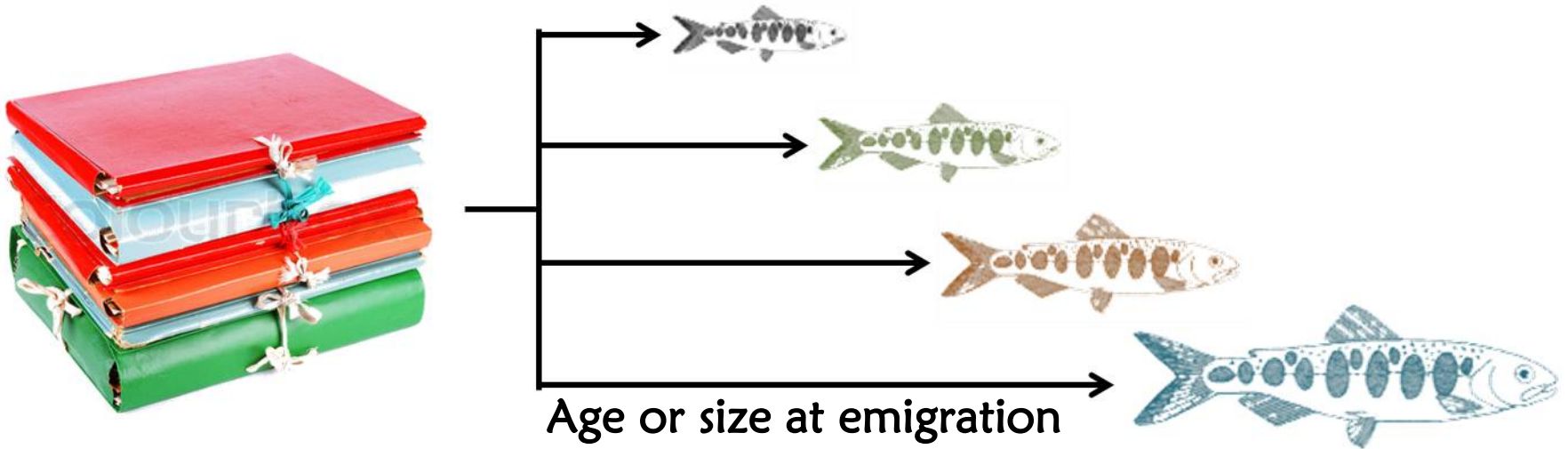


Export Restrictions

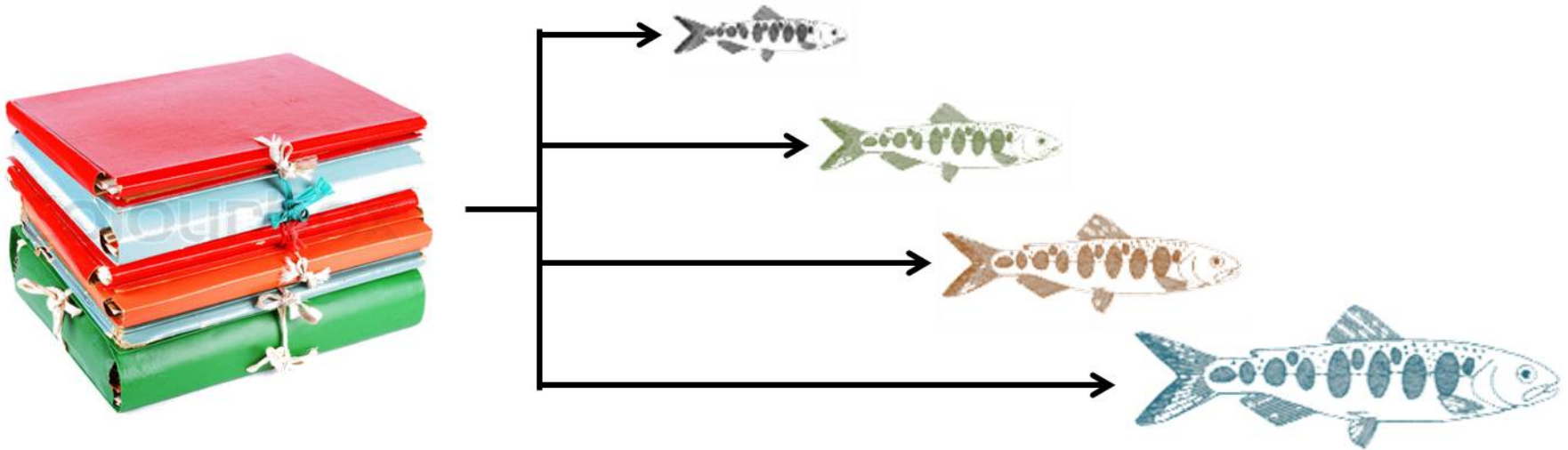
Ocean Habitat

“Bet Hedging” Model

Life history diversity: a diversified asset portfolio for salmon

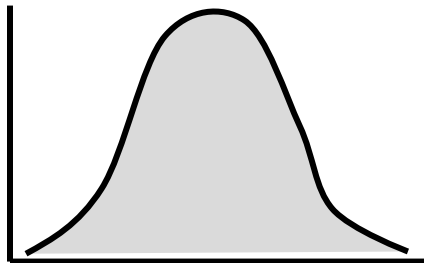


Life history diversity: a diversified asset portfolio for salmon



Life History Distribution

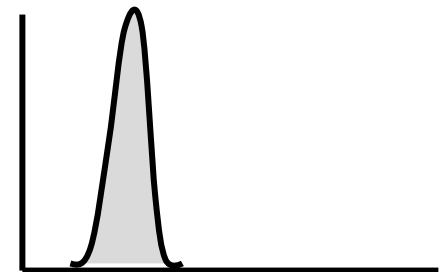
Broad



Timing of Ocean Entry

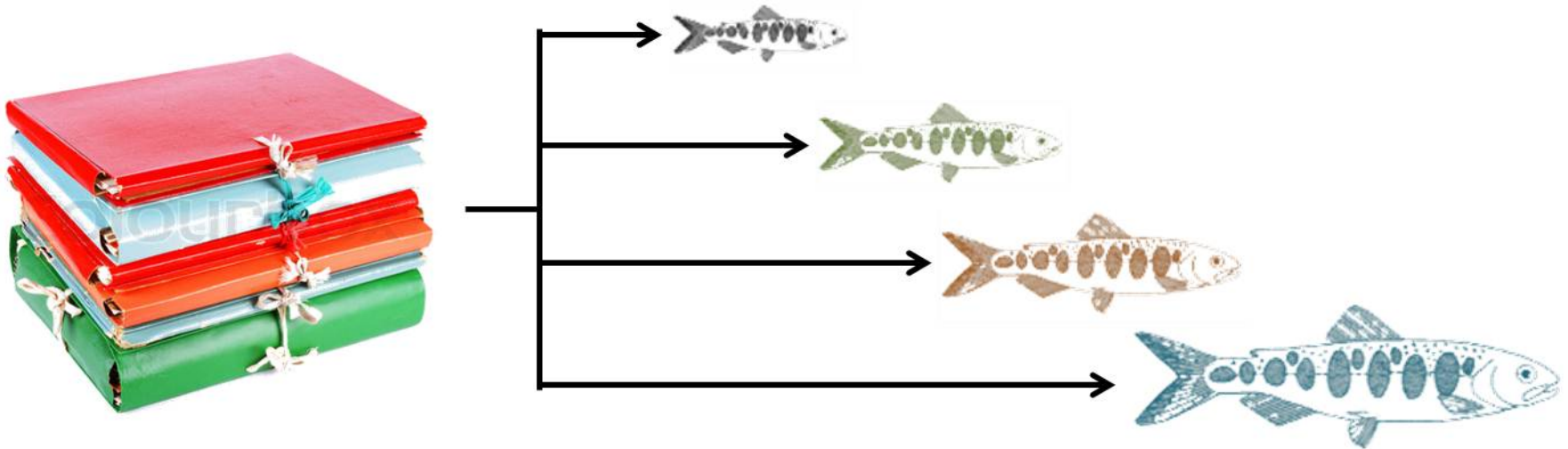
vs.

Narrow

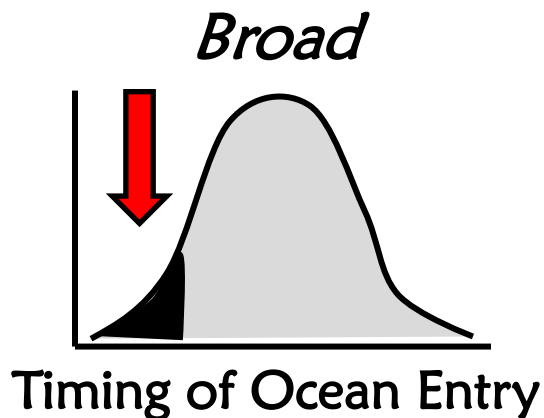


Timing of Ocean Entry

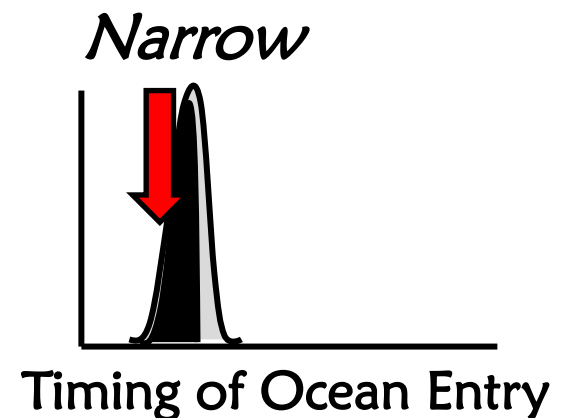
Life history diversity: a diversified asset portfolio for salmon



Life History Distribution



vs.



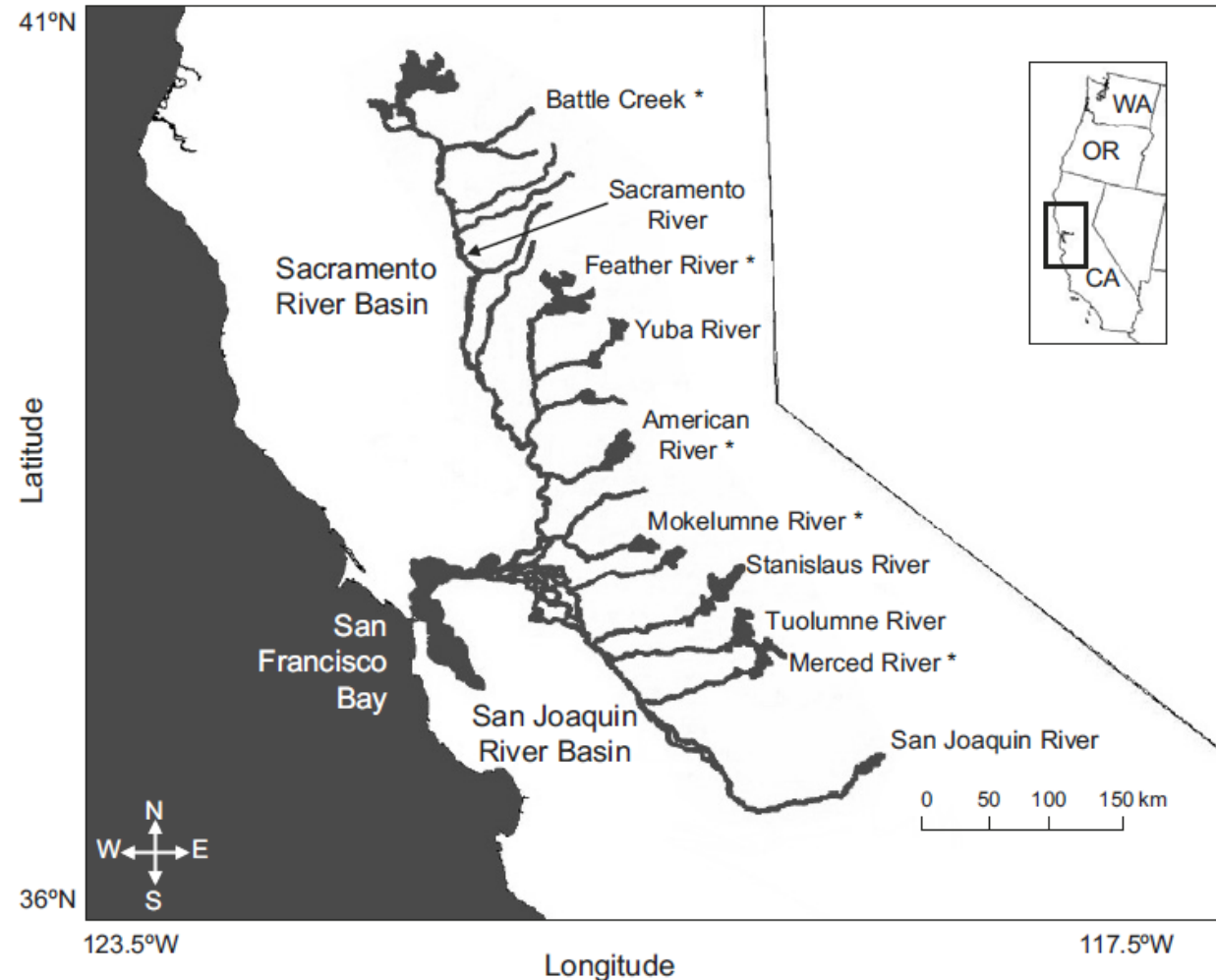
Weakened portfolio effect in a collapsed salmon population complex

Stephanie Marie Carlson and William Hallowell Satterthwaite

Can. J. Fish. Aquat. Sci. 68: 1579–1589 (2011)

doi:10.1139/F2011-084

Published by NRC Research Press



*Adapted from
Carlson and Satterthwaite (2011)*

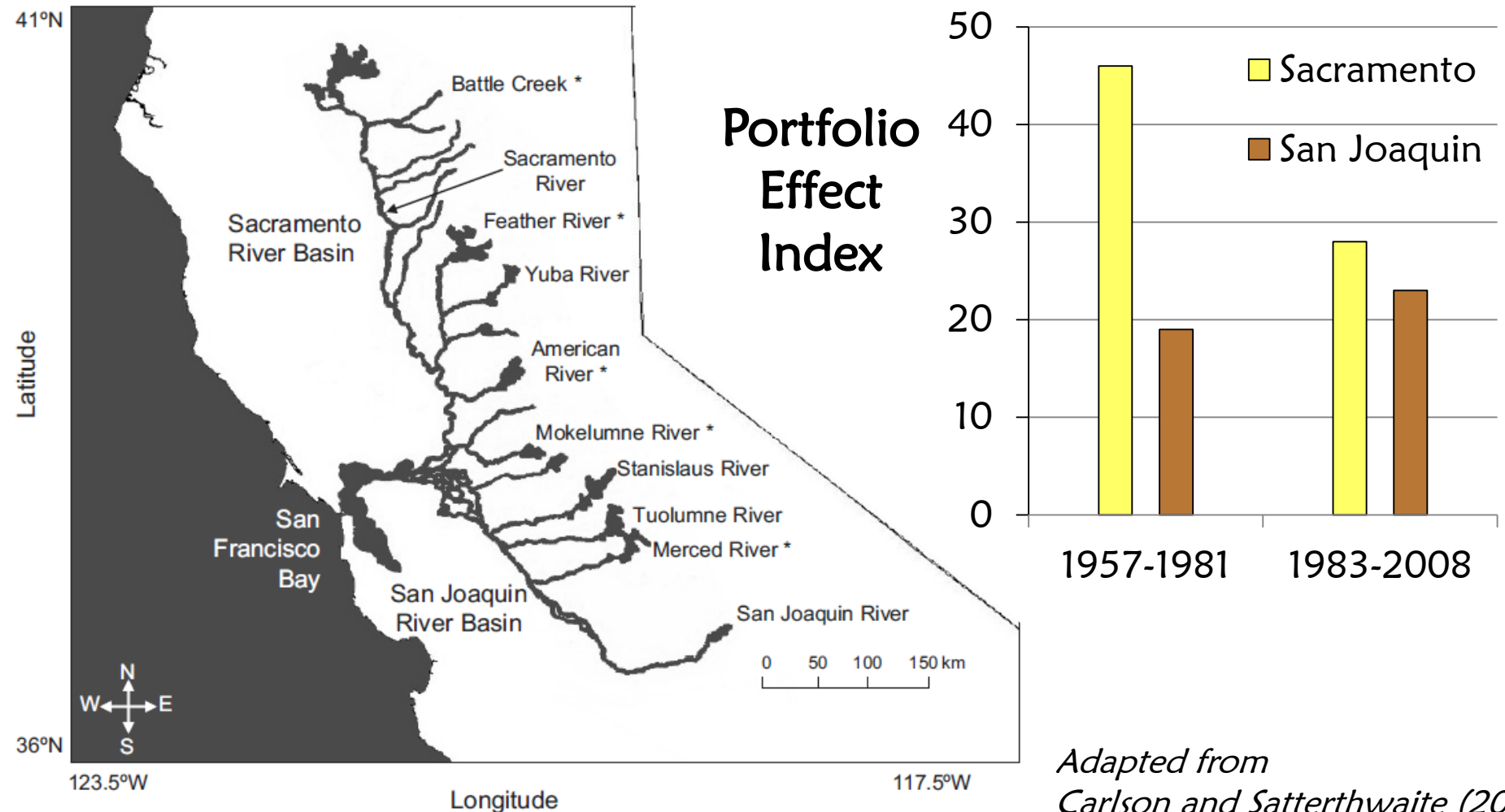
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Delta rearing is more important than previously understood

Coded Wire Tag Fry



Delta residence time

55-58 days

(Sommer et al. 2001)

Delta rearing is more important than previously understood

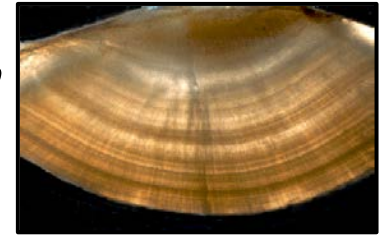
Coded Wire Tag Fry



Delta residence time
55-58 days
(Sommer et al. 2001)

Fry are
major contribution
to Population
(Miller et al. 2010)

Otolith Studies



Delta rearing is more important than previously understood

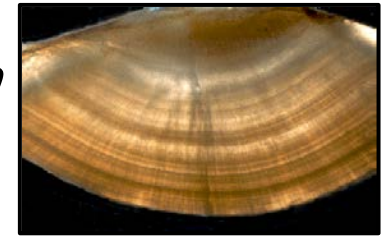
Coded Wire Tag Fry



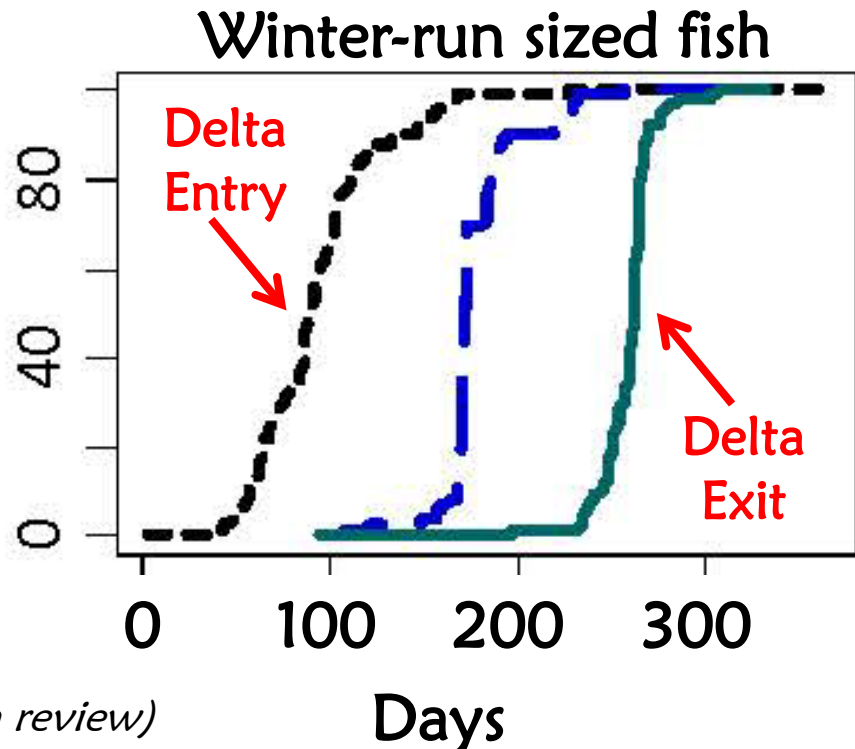
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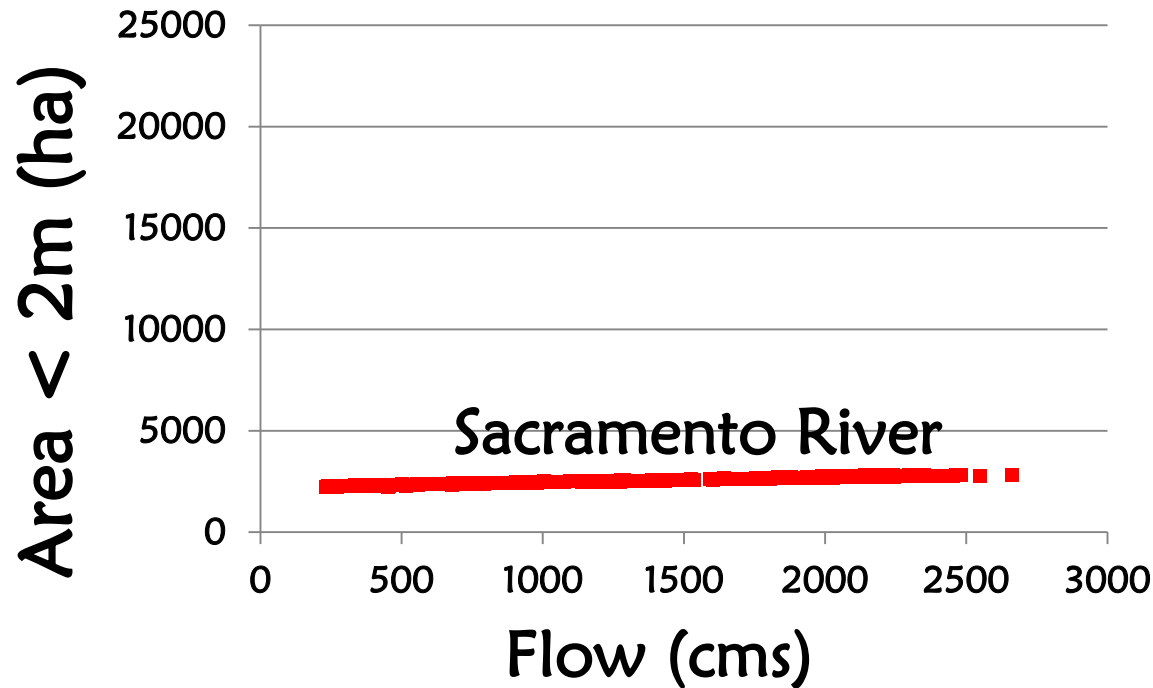


Cumulative Catch



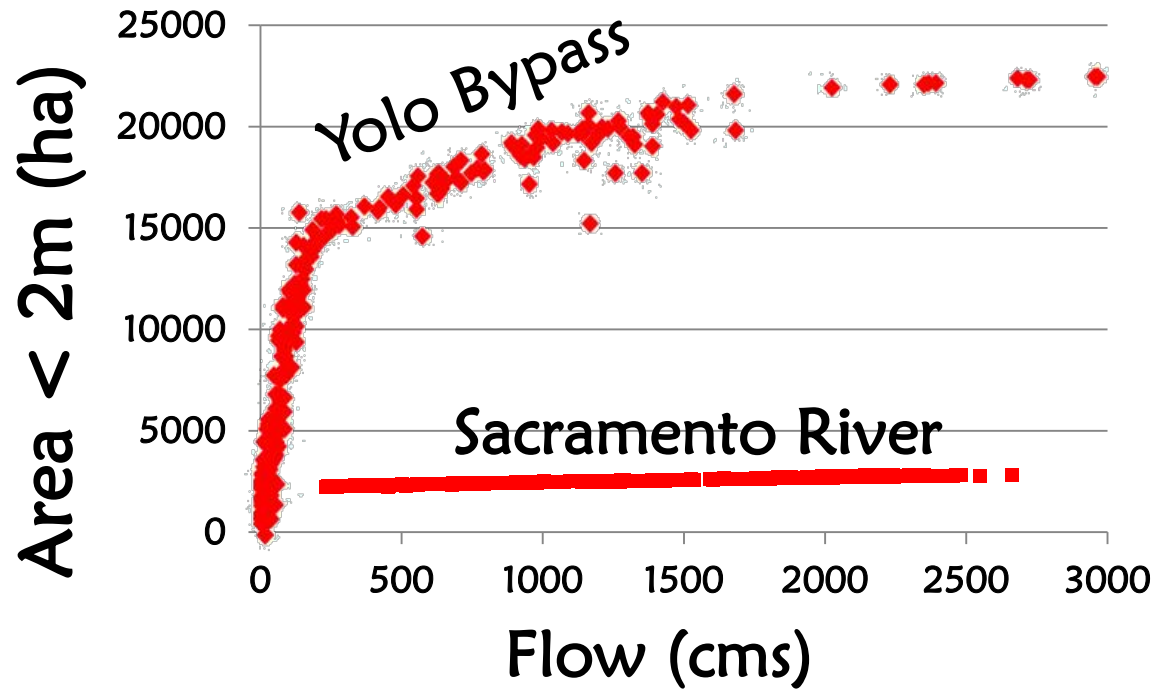
(del Rosario et al. in review)

Flow has little effect on habitat area in the lower Sacramento River

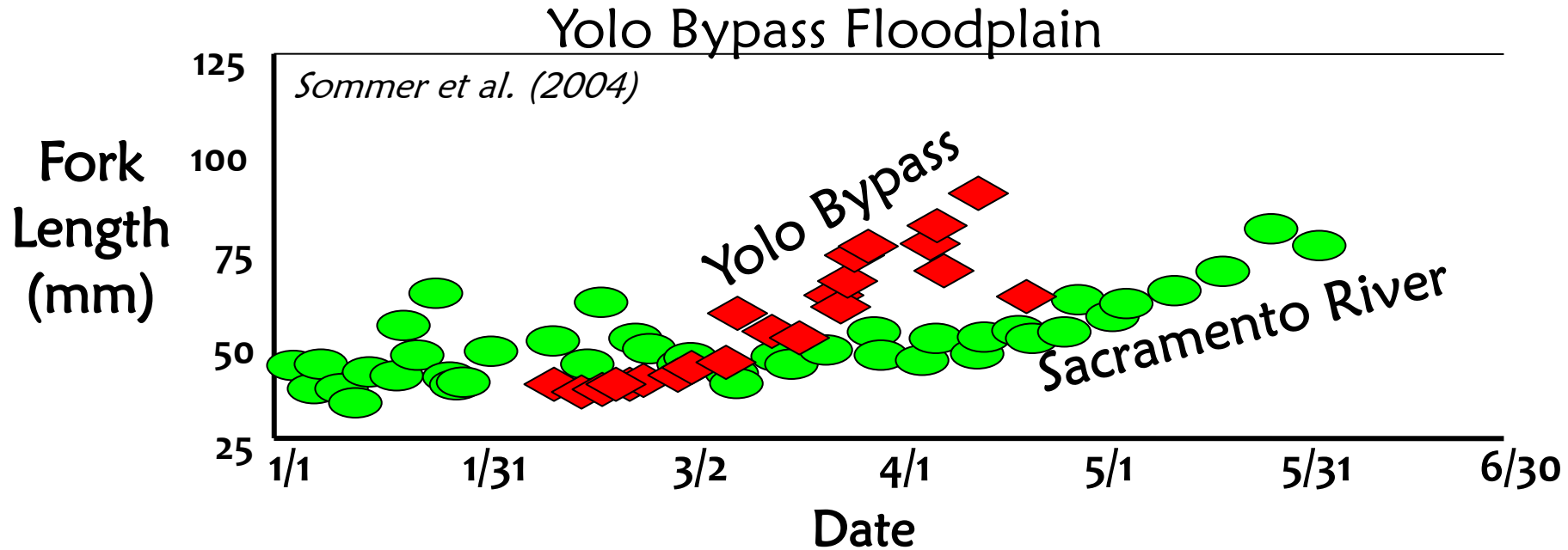


Steep Banks = Little Habitat At All Flows

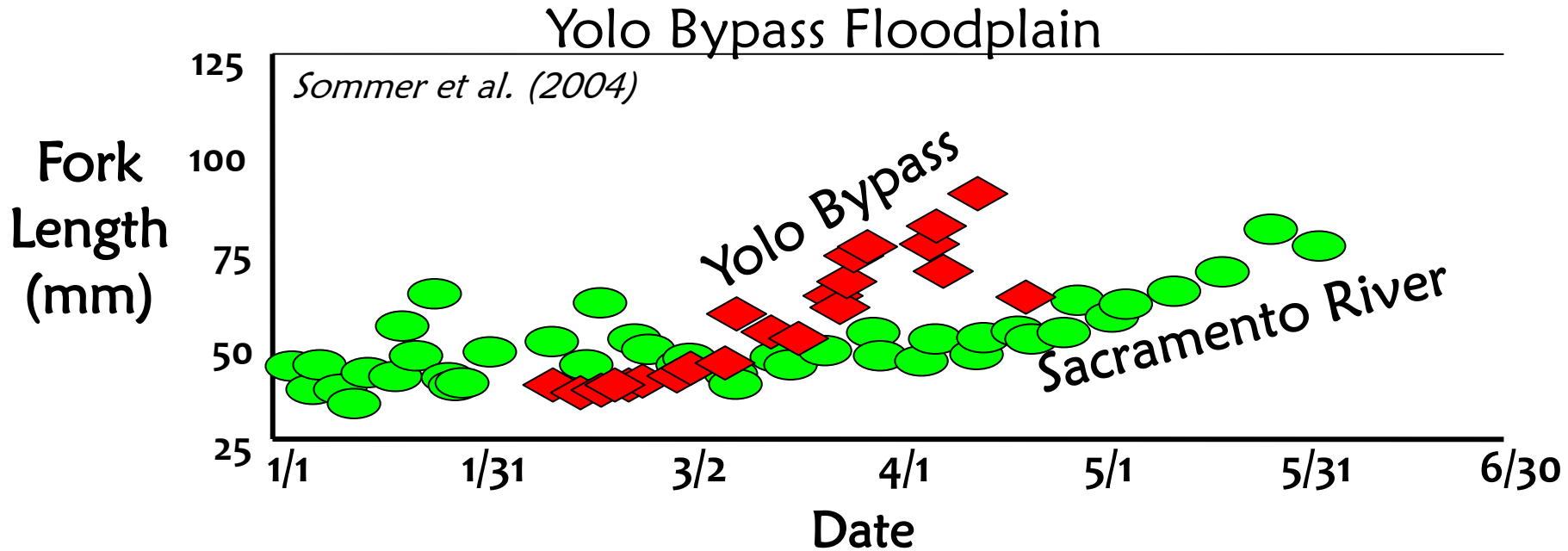
By contrast, even modest Yolo Bypass flows create huge habitat areas



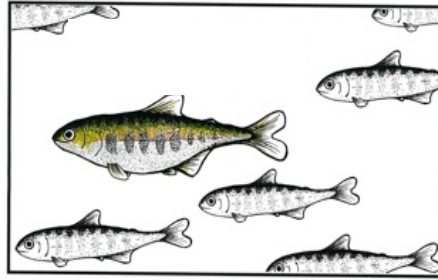
Floodplains support exceptional salmon growth



Floodplains support exceptional salmon growth



Rip-Rap is poor rearing habitat for salmon



Young salmon avoid
rip-rap



Garland et al. (2002)

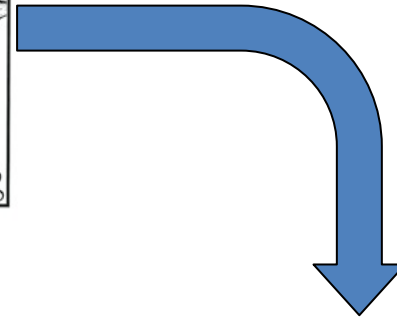
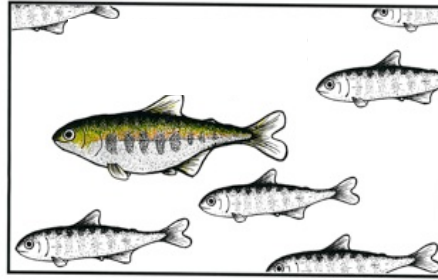
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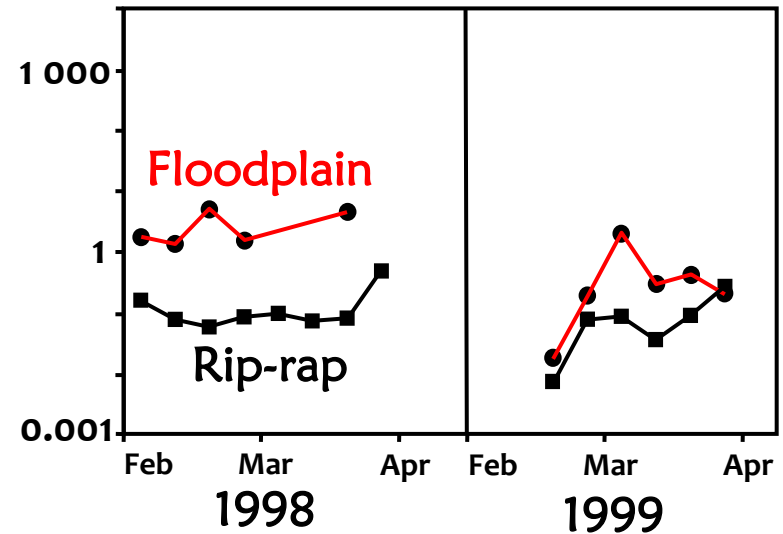


Garland et al. (2002)



Low food
in rip-rap channels

Prey
Density
(log scale)



Sommer et al. (2001)

Evidence that tidal wetlands are important rearing habitat for salmon

Liberty Island



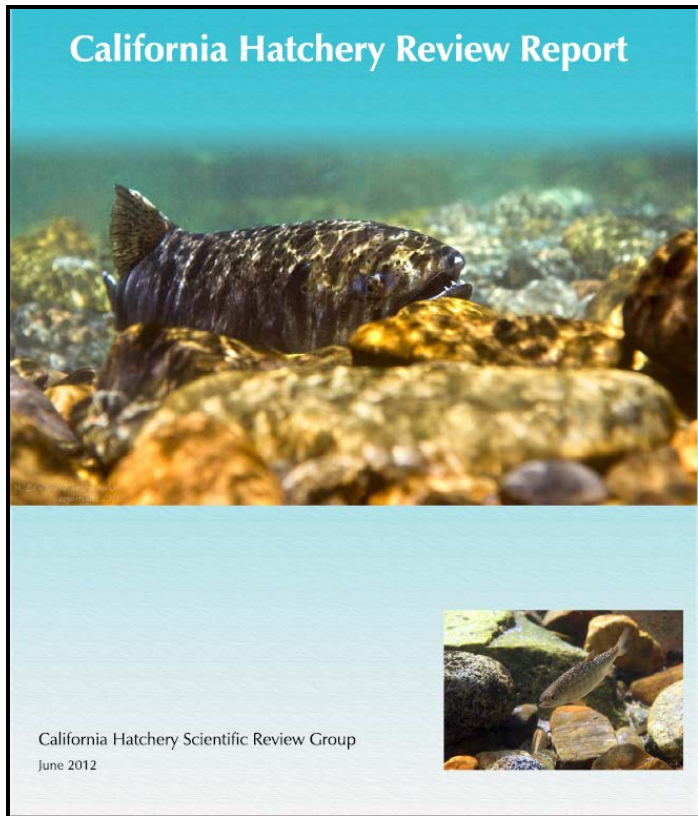
McLain and Castillo (2010)

Northwestern Estuaries



Shreffler et al. (1990)
Miller and Simenstad (1997)
Bottom et al. (2005a,b)

Hatchery practices need improvement



THE SACRAMENTO BEE

Report recommends changes at California salmon hatcheries

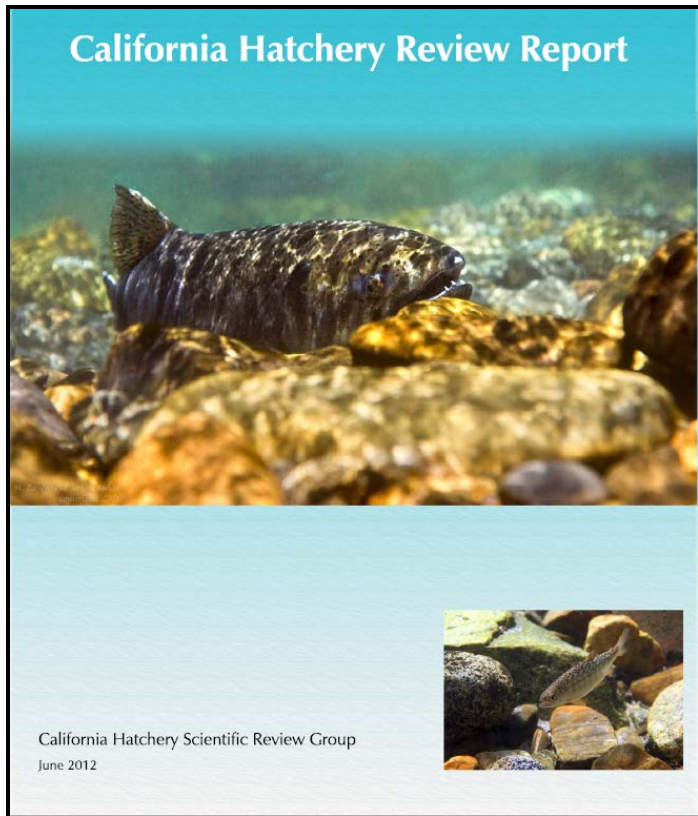


sacbee.com

mweiser@sacbee.com

PUBLISHED WEDNESDAY, AUG. 08, 2012

Hatchery practices need improvement



THE SACRAMENTO BEE



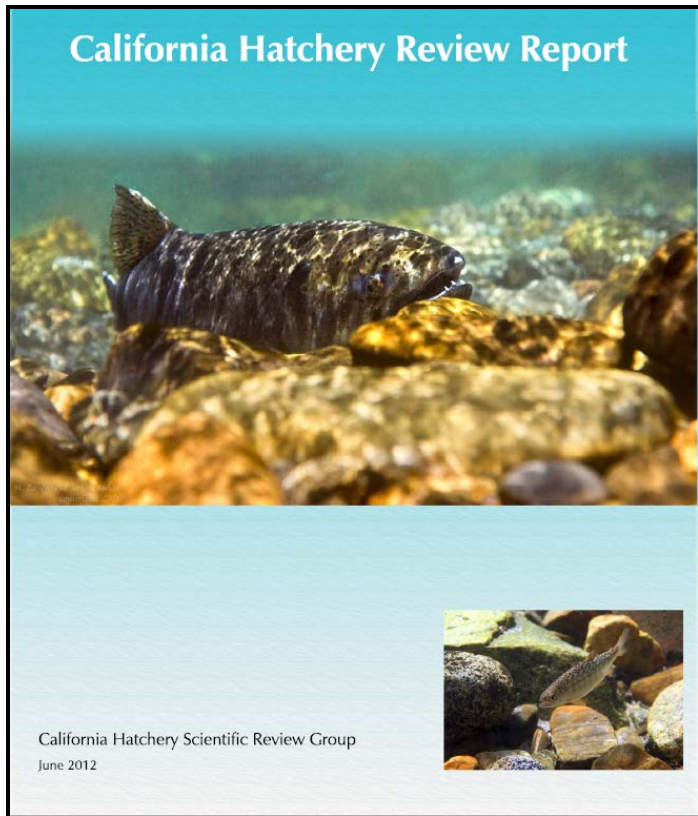
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**Report recommends changes at
California salmon hatcheries**

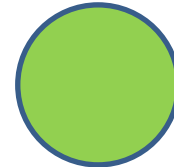
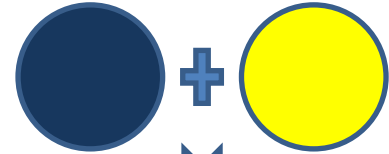
mweiser@sacbee.com

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Hatchery practices need improvement



Segregated hatchery & wild



Integrated hatchery & wild

THE SACRAMENTO BEE



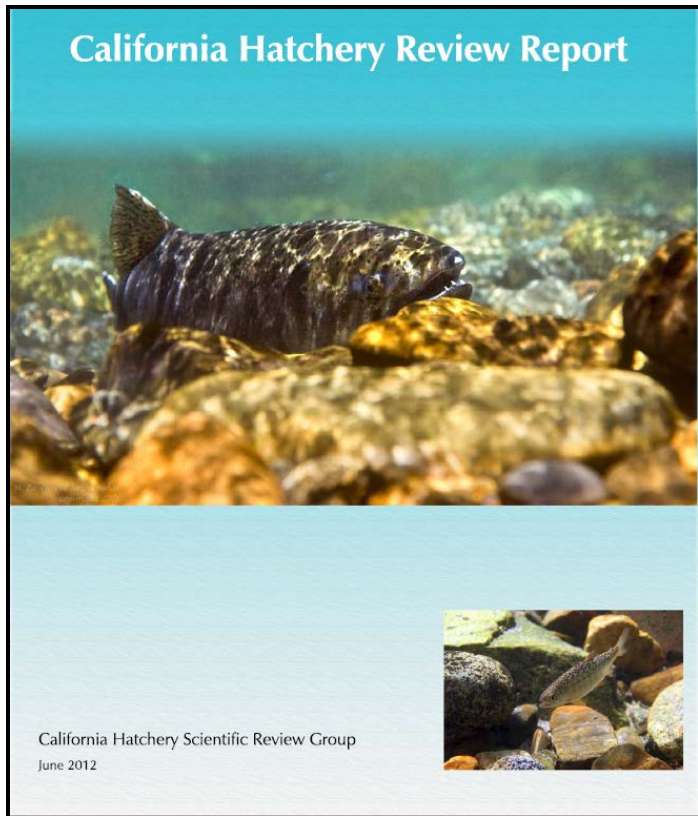
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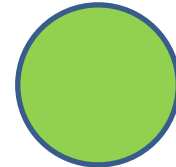
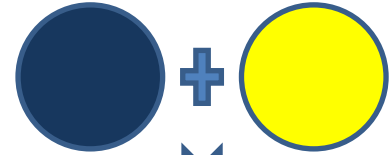
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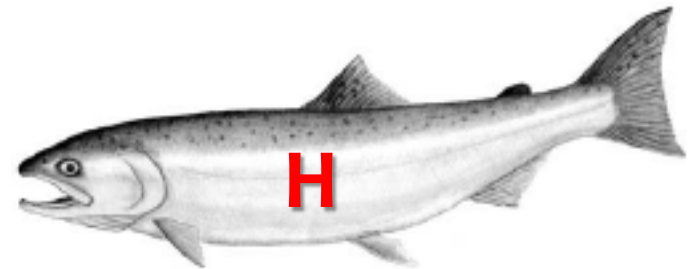
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100% Marked



Improved Hatchery Management



Stream Restoration

Riparian Corridors



Brackish Marsh



Freshwater Tidal Wetlands



Seasonal Floodplain



Gate Closures



Export Restrictions

Ocean Habitat

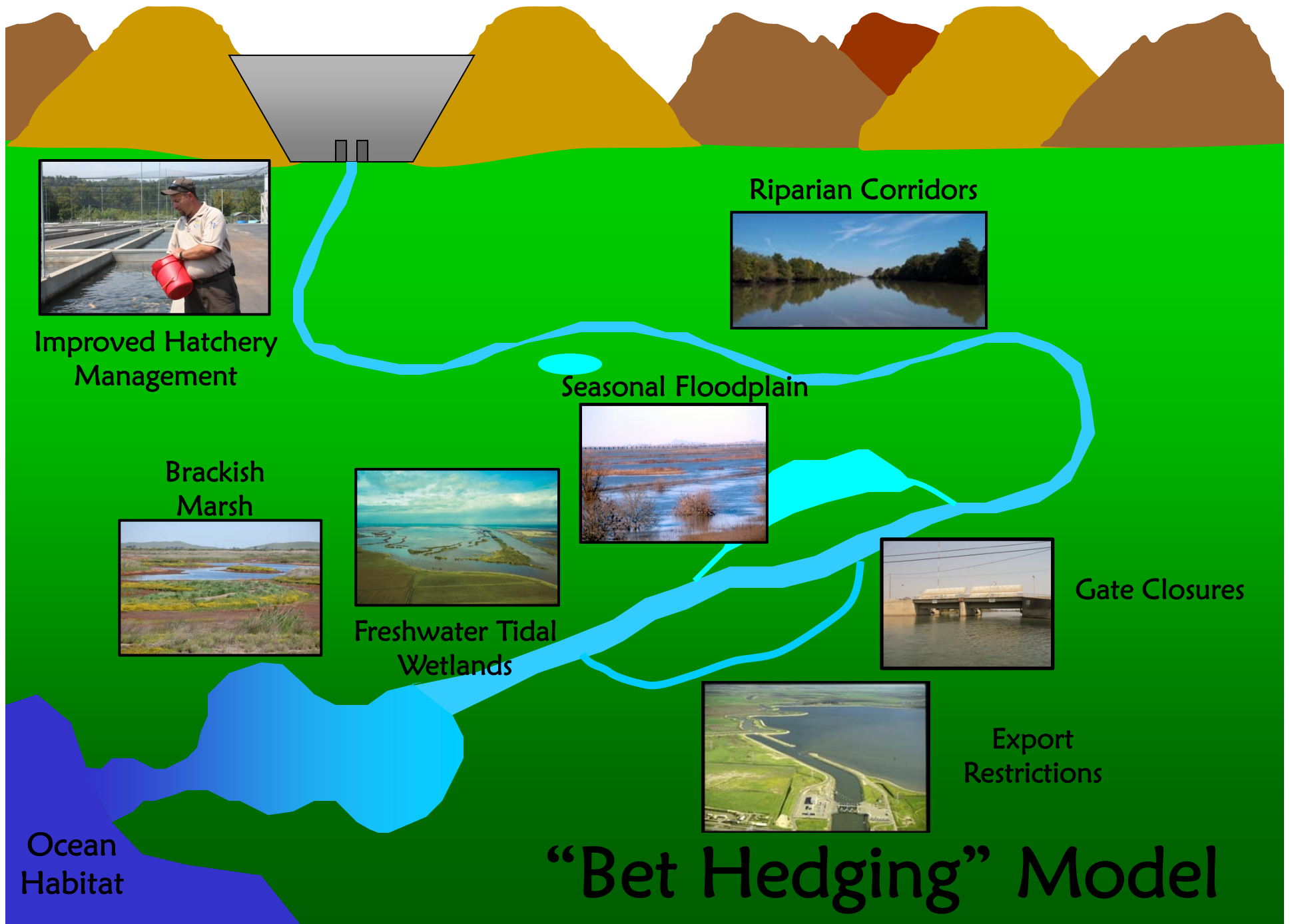
“Bet Hedging” Model

The Bay Delta Conservation Plan

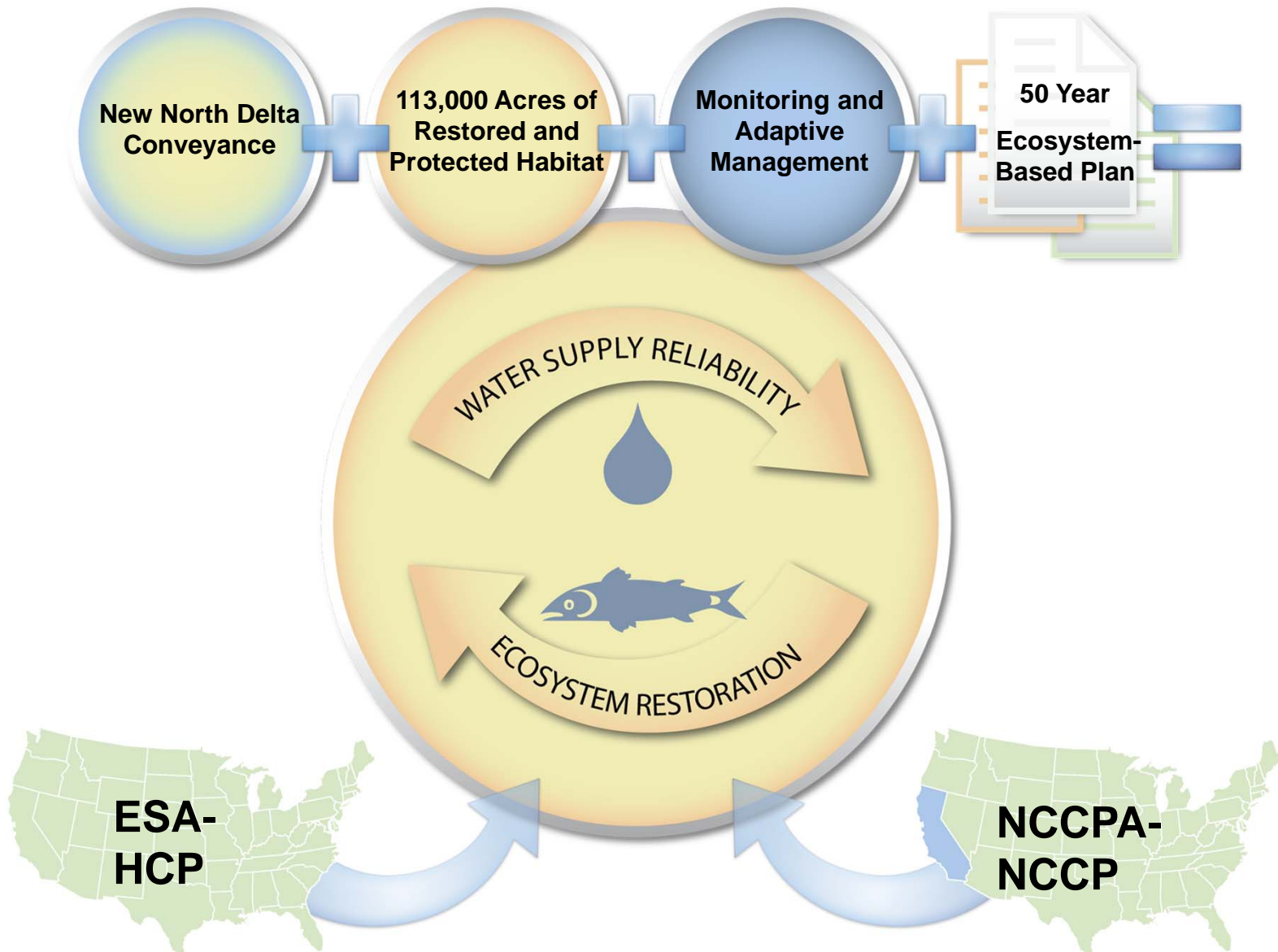
Gardner Jones

Environmental
Scientist

DWR



Bay Delta Conservation Plan

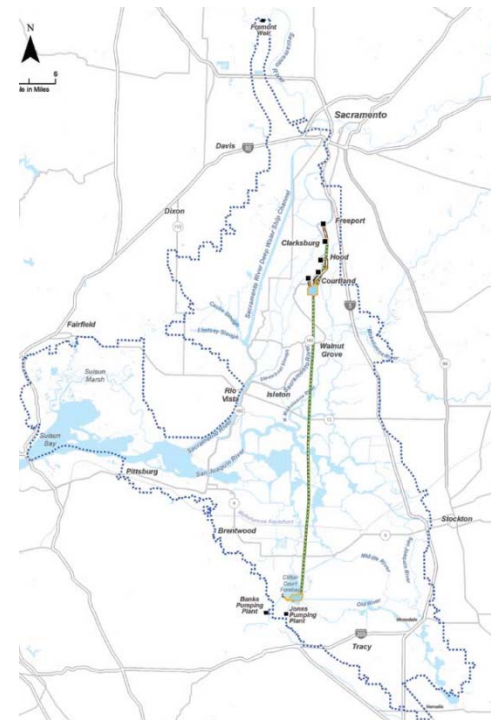


BDCP Foundation

- Large Scale Restoration



- Alternative Conveyance



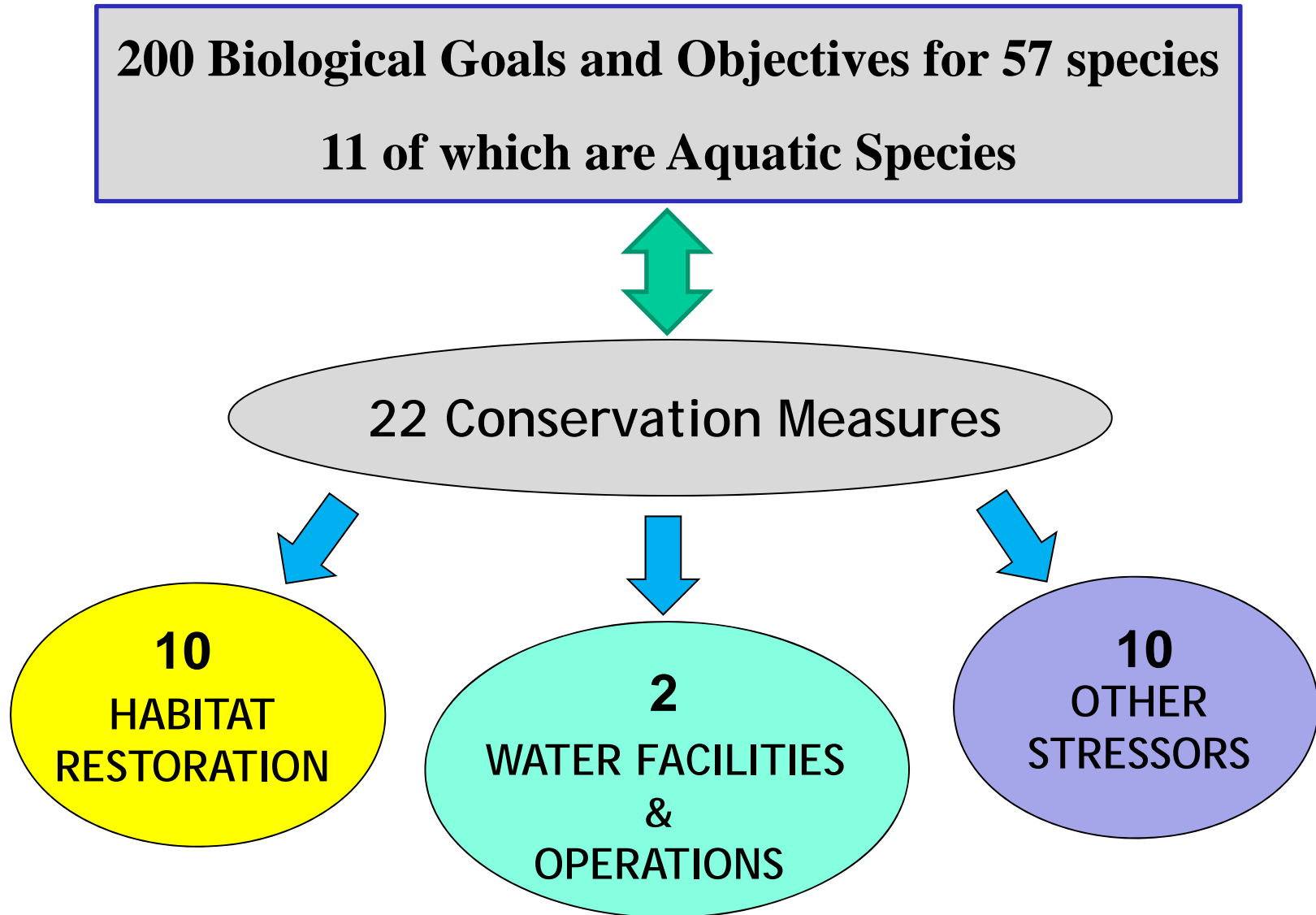
Approach Based on Best Available Science

- Decades of Research and studies in the Delta
- CALFED & ERP
- Reports by Delta Vision Blue Ribbon Task Force, Public Policy Institute of California
- Independent Science Advisors

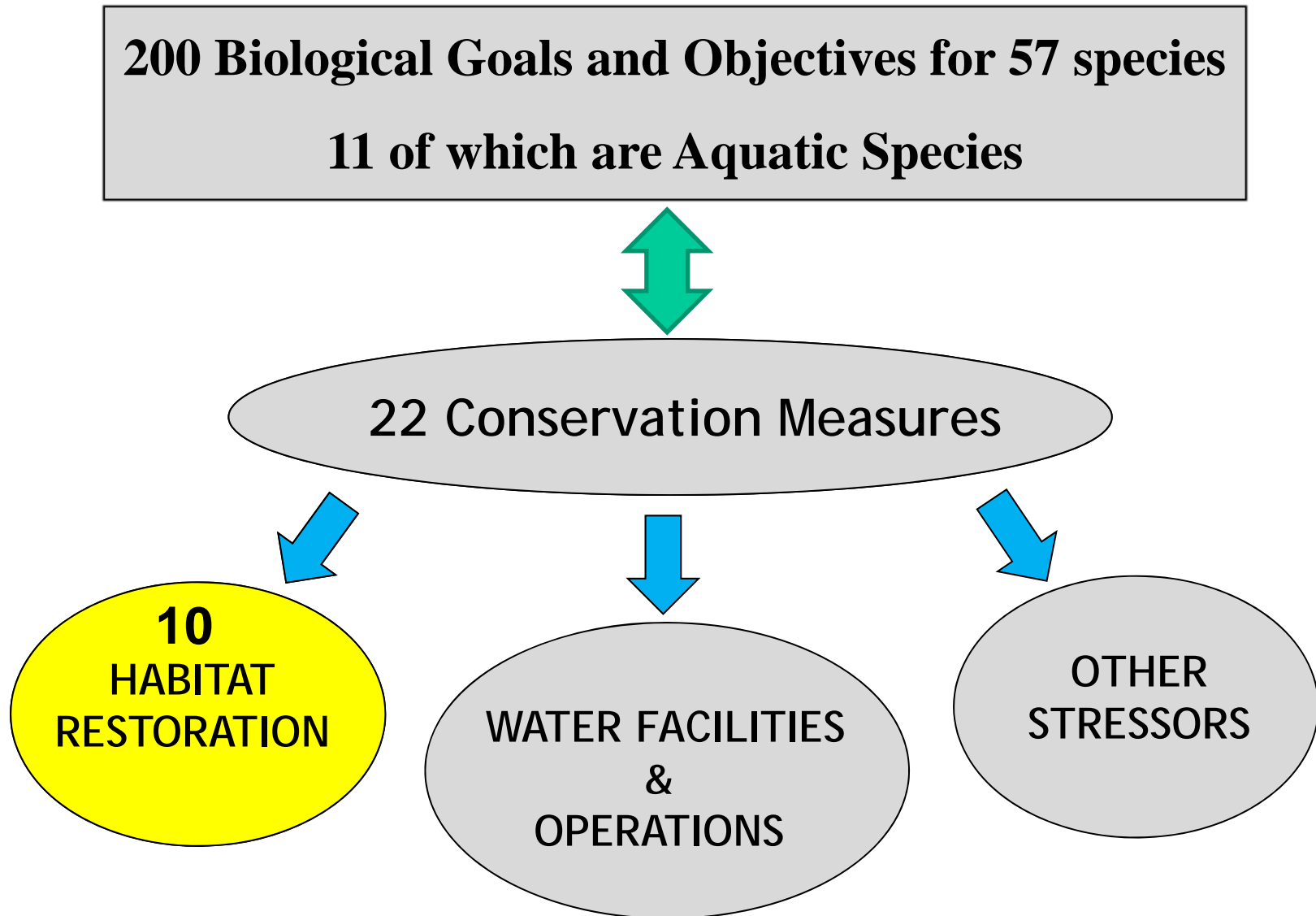
<http://baydeltaconservationplan.com>



BDCP Conservation Strategy – Major Elements



BDCP Conservation Strategy – Major Elements



Habitat Restoration Goals

- More than 100,000 acres of Restored and Protected Habitat in the Delta over 50 Years
 - 30,000 acres of restored aquatic habitat in next 15 years



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 - 30,000 acres of restored aquatic habitat in next 15 years
- 65,000 acres of Restored Tidal Habitat
- 10,000 acres of Restored Floodplain
- 20 Levee Miles of Restored Channel Margin



Habitat Restoration Goals

- More than 100,000 acres of Restored and Protected Habitat in the Delta over 50 Years
 - 30,000 acres of restored aquatic habitat in next 15 years
- 65,000 acres of Restored Tidal Habitat
- 10,000 acres of Restored Floodplain
- 20 Levee Miles of Restored Channel Margin
- Enhanced Floodplain Habitat in the Yolo Bypass
- Thousands of acres of Restored and Protected Riparian & Terrestrial Habitat



Conservation Measure 6: Channel Margin Enhancement



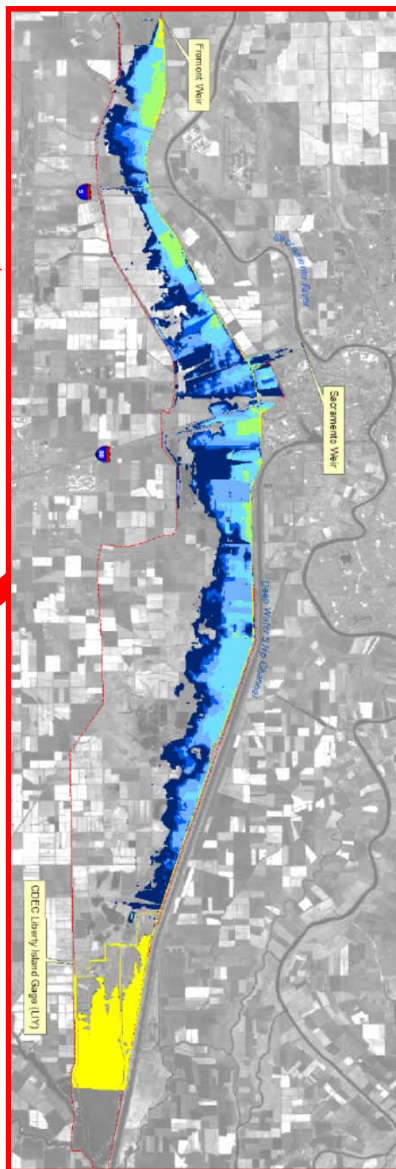
Conservation Measure 4: Tidal Natural Communities Restoration



Conservation Measure 2: Yolo Bypass Fisheries Enhancement



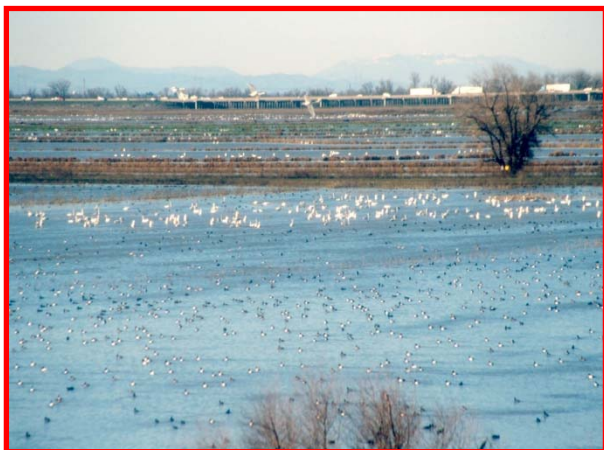
Yolo Bypass Restoration Concepts



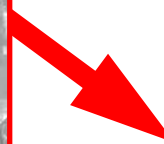
Fish Passage



Rearing Habitat

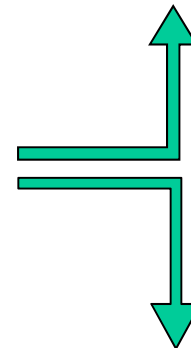
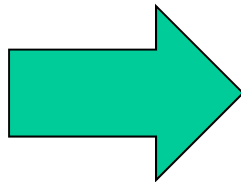
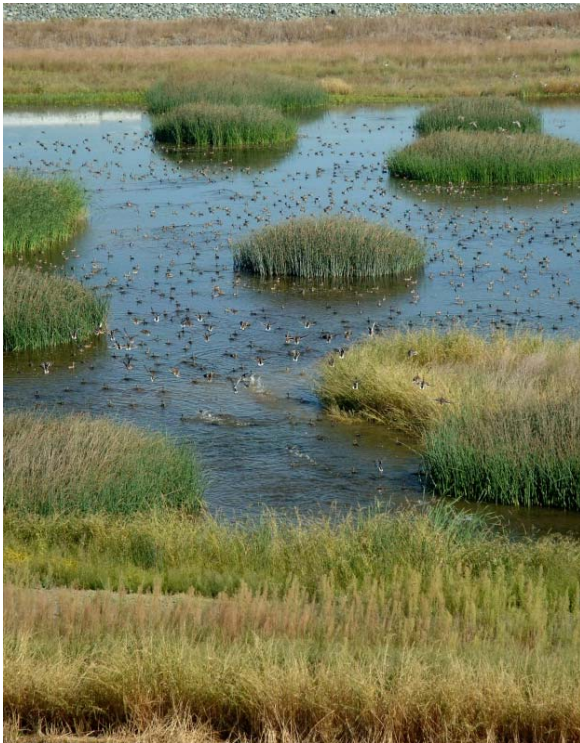


Exports to Estuary

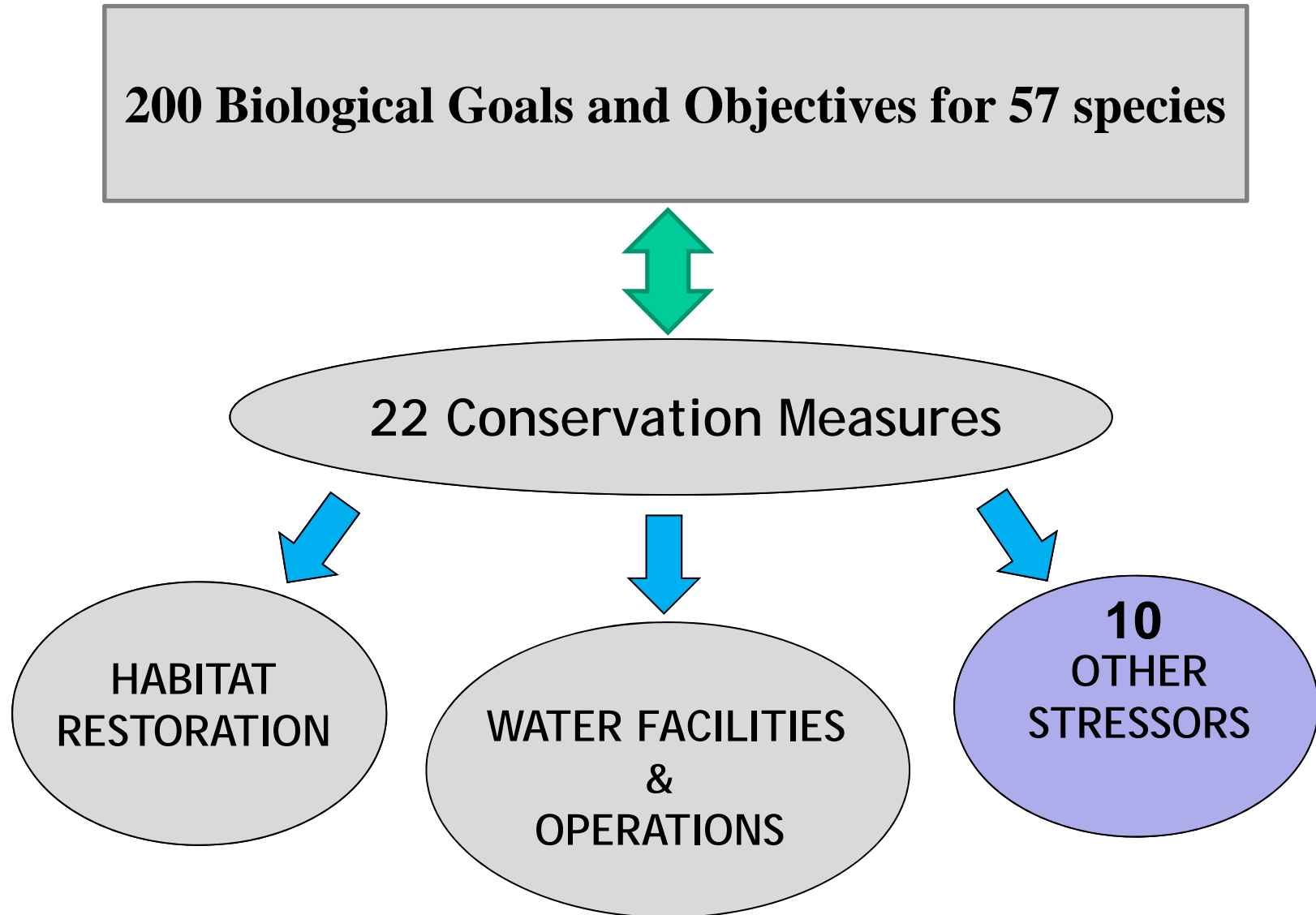


Dealing with Variability and Uncertainty

- Goals and Objectives
- Monitoring
- Adaptive Management



BDCP Conservation Strategy – Major Elements



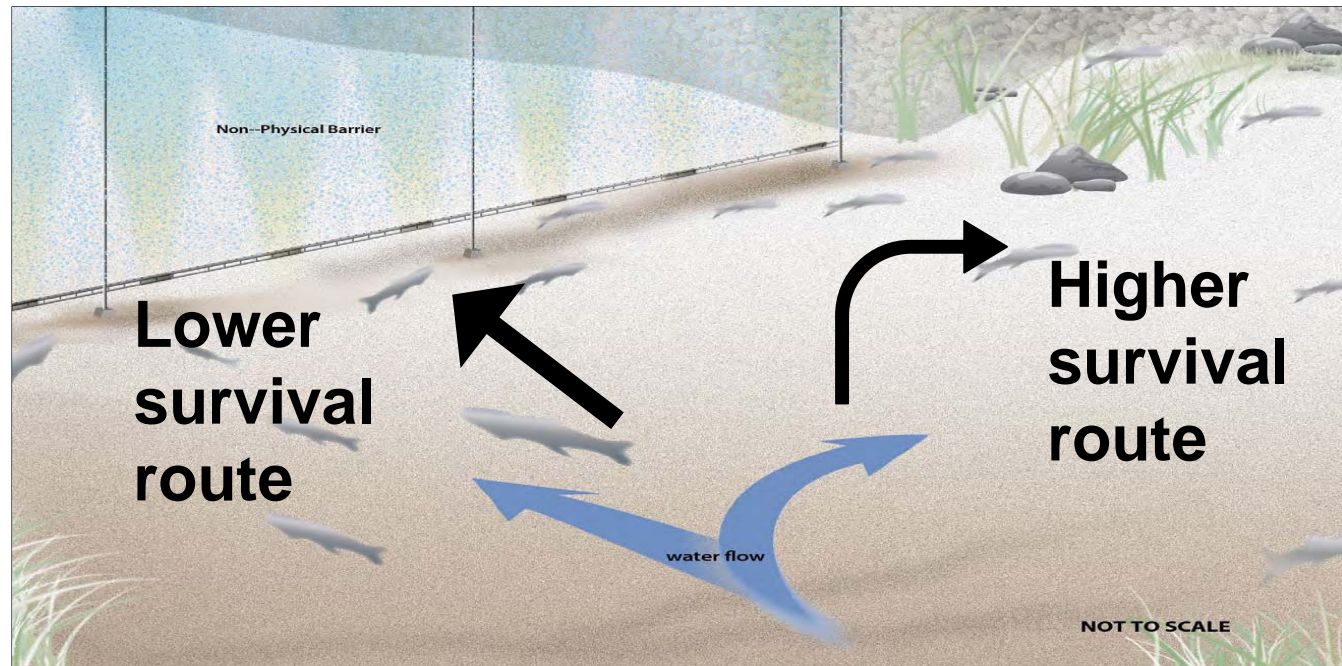
Other Stressors Conservation Measures

- CM 12: Methylmercury Management
- CM 14: Stockton Deep Water Ship Channel Dissolved Oxygen Levels
- CM 19: Urban Stormwater Treatment

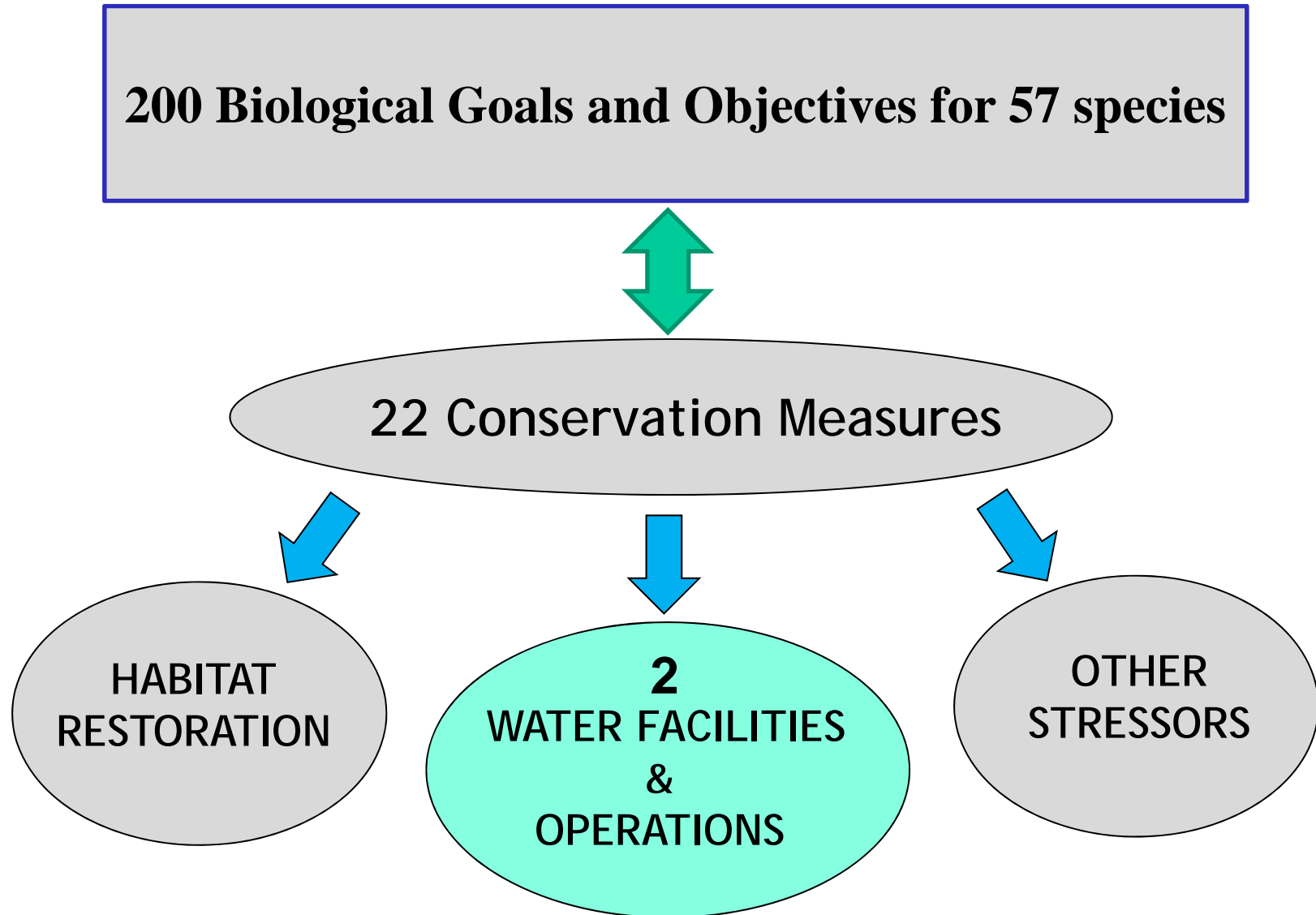
- CM 15: Predator Control



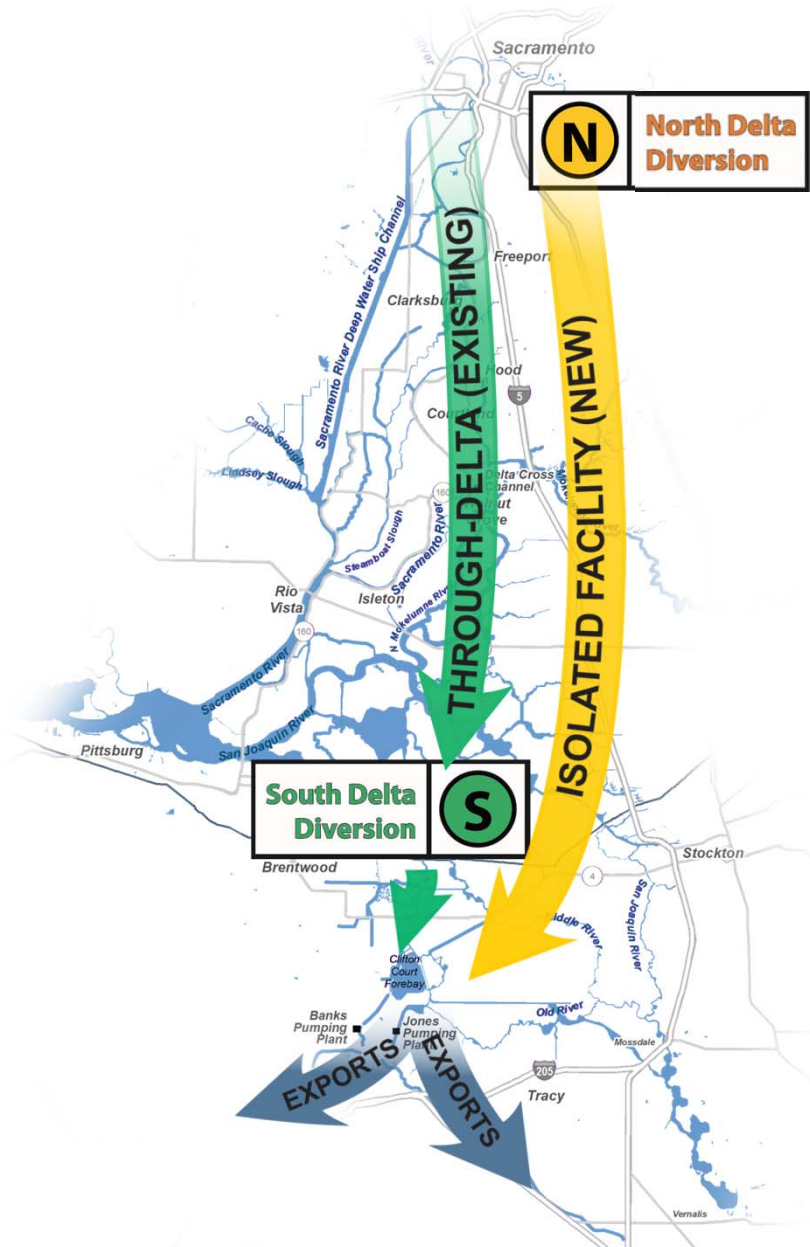
- CM 16: Nonphysical Fish Barriers



BDCP Conservation Strategy – Major Elements



Conservation Measure 1: Dual Conveyance



N

The **North Delta Diversion** would be the primary diversion point and would be subject to strict water operations rules

S

N

The **North Delta Diversion** would be used in conjunction with the existing **South Delta Diversion** when it is necessary to maintain water quality and safe for fish

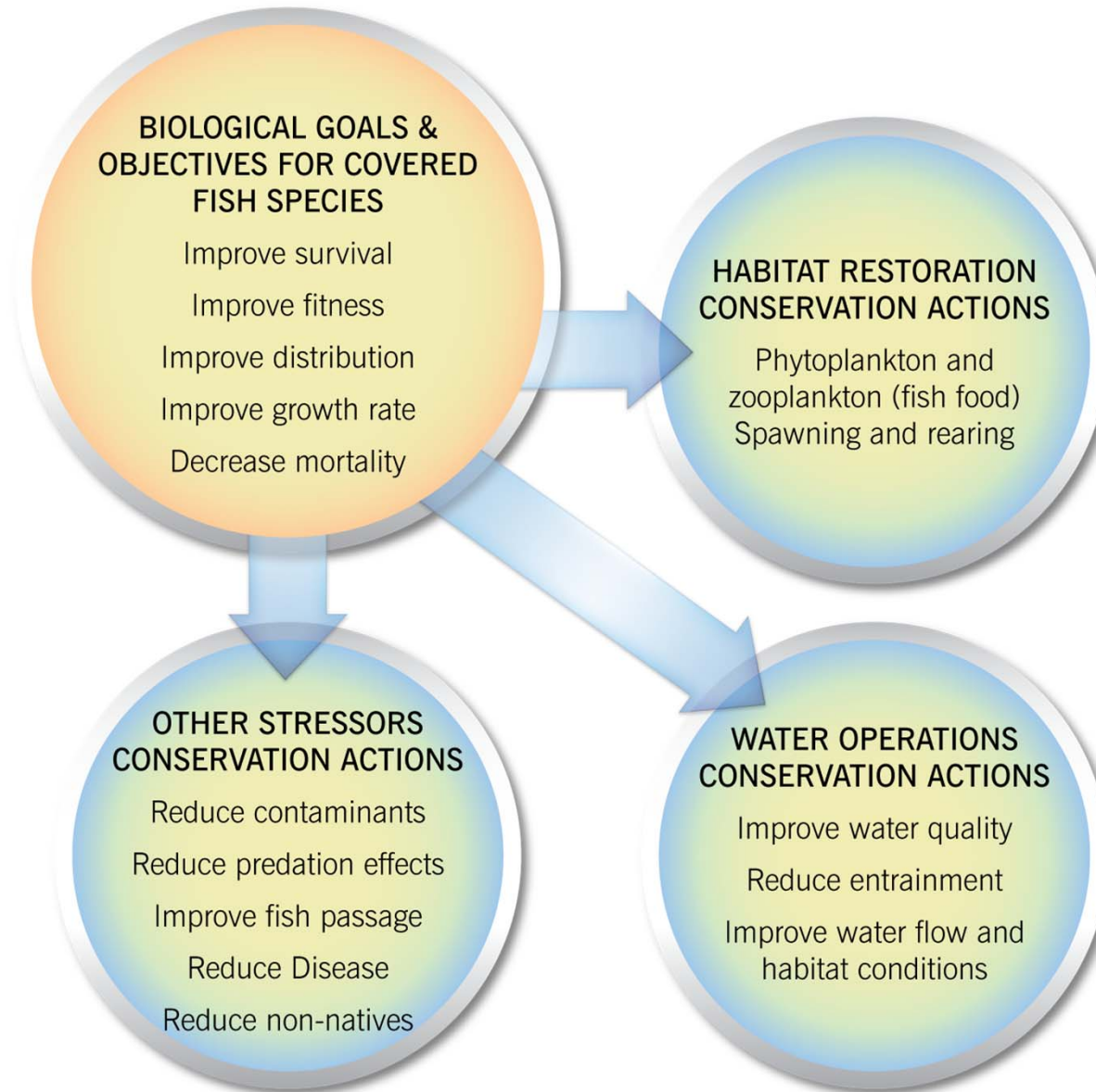
S

N

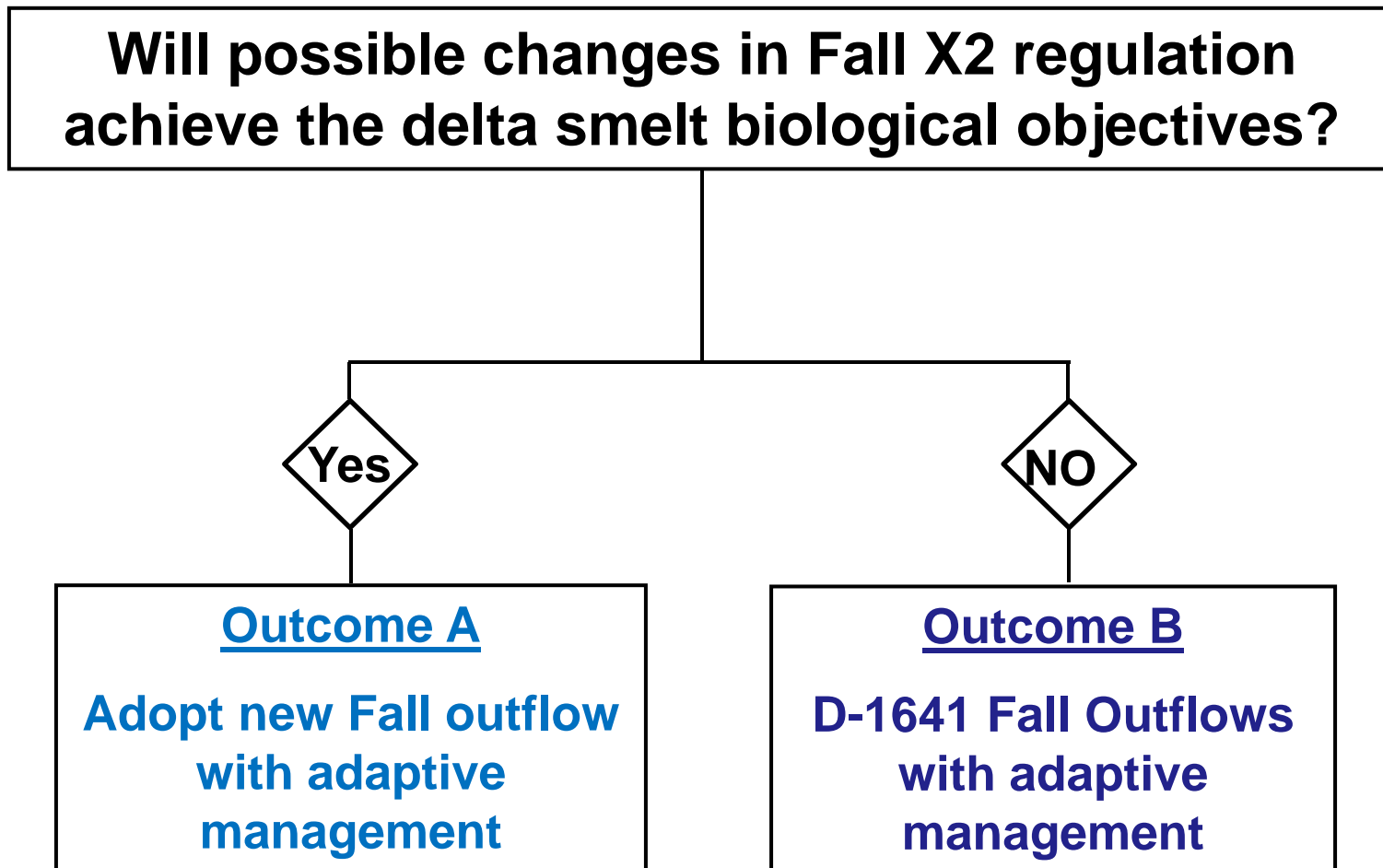
The **South Delta Diversion** would be preferentially operated when safe for fish and when the **North Delta Diversion** is restricted

S

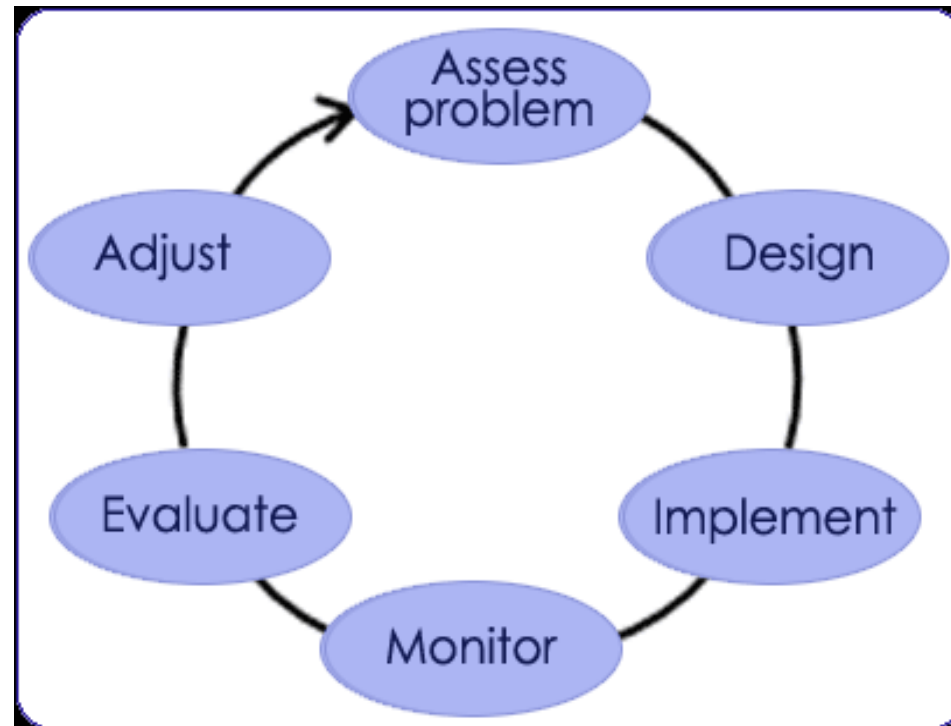
BDCP Approach to Ecosystem Restoration



Hypothetical Decision Tree for Fall Outflow



Adaptive Management Program



Source: Delta Plan

Near-Term Habitat Restoration Actions in the Delta, Suisun Marsh, and Yolo Bypass

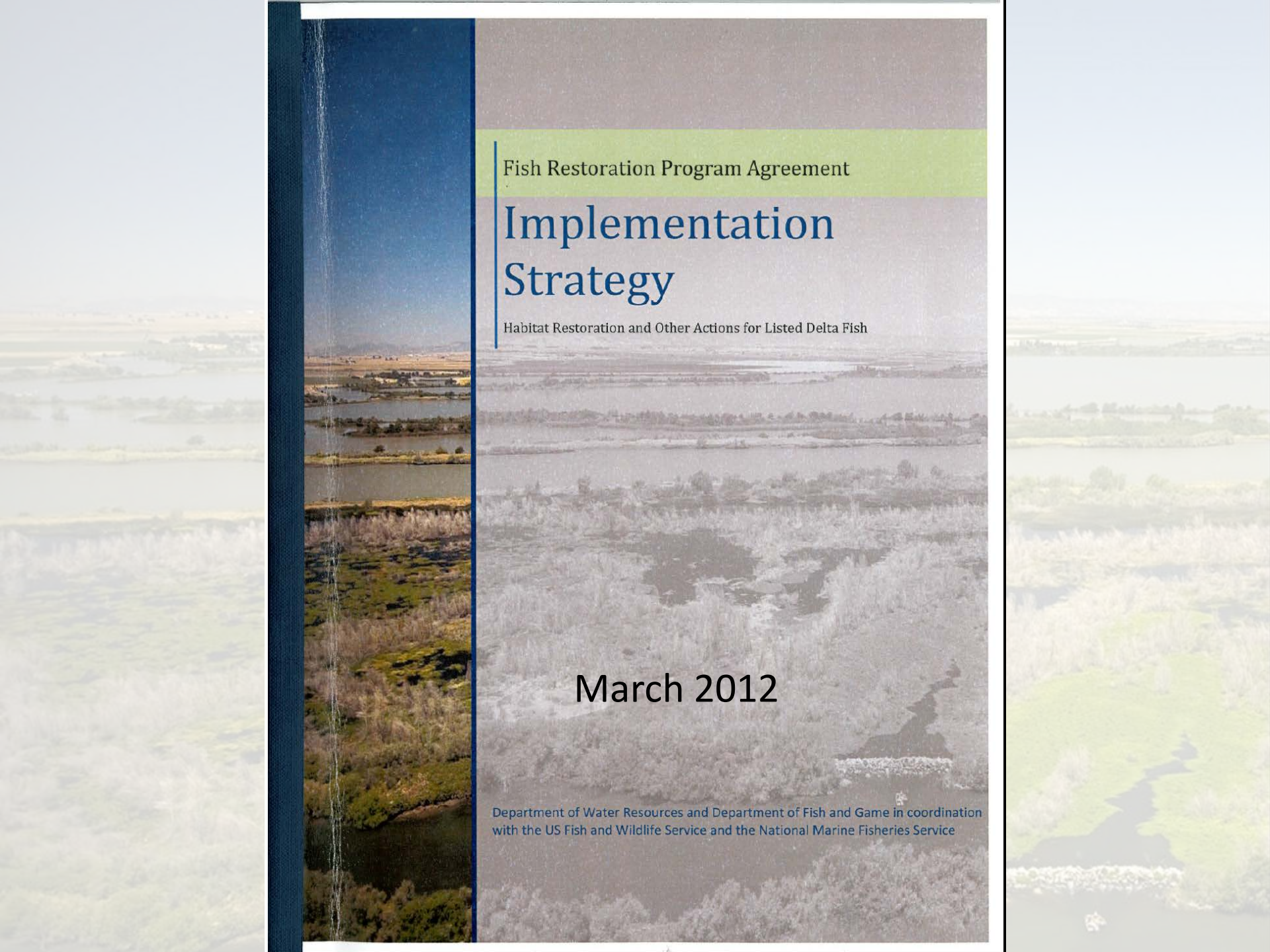


Overview

- Restoration Requirements
- Goals and Objectives
- Implementation Strategy
- Project areas
 - Cache Slough Complex
 - Suisun Marsh
 - Yolo Bypass

Fish Restoration Program Agreement (FRPA)

- Executed October 2010
- Joint DWR and DFG program
- Fulfill habitat restoration requirements
 - USFWS Delta Smelt BiOp, RPA 4
 - NMFS Salmonid BiOp, Action 1.6.1
 - DFG Longfin Smelt ITP, Condition 7



Fish Restoration Program Agreement

Implementation Strategy

Habitat Restoration and Other Actions for Listed Delta Fish

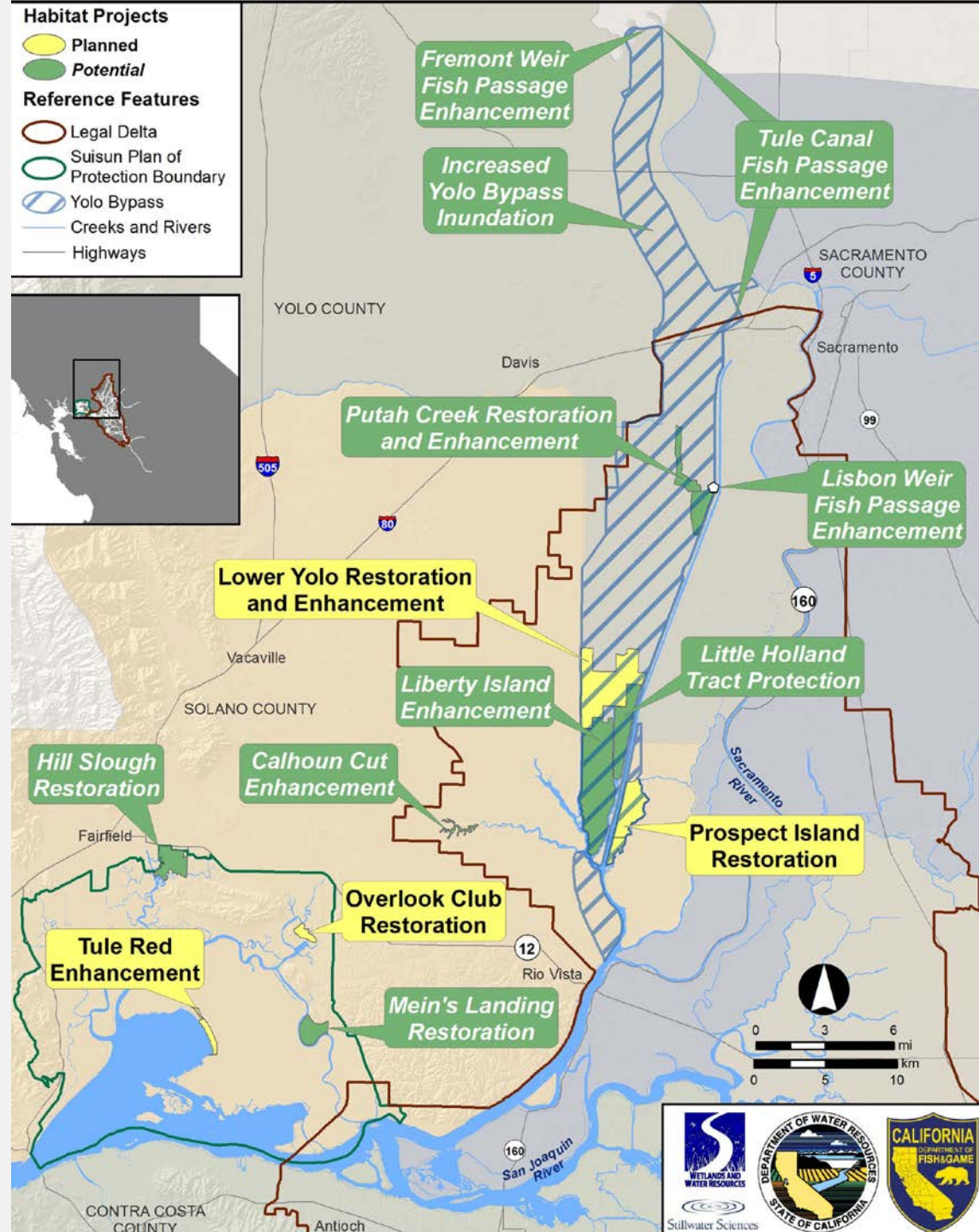
Department of Water Resources and Department of Fish and Game in coordination
with the US Fish and Wildlife Service and the National Marine Fisheries Service

Restoration Goals and Objectives

- 8,000 acres of intertidal and associated subtidal habitat over 10 years
- Restore functions and processes that promote primary and secondary productivity and export to pelagic habitat
- Enhance migratory pathways for salmonids by increasing the amount and quality of rearing habitat
- Monitor and adaptively manage restoration areas to ensure desired ecological outcomes
- Consistent with other Delta plans and programs

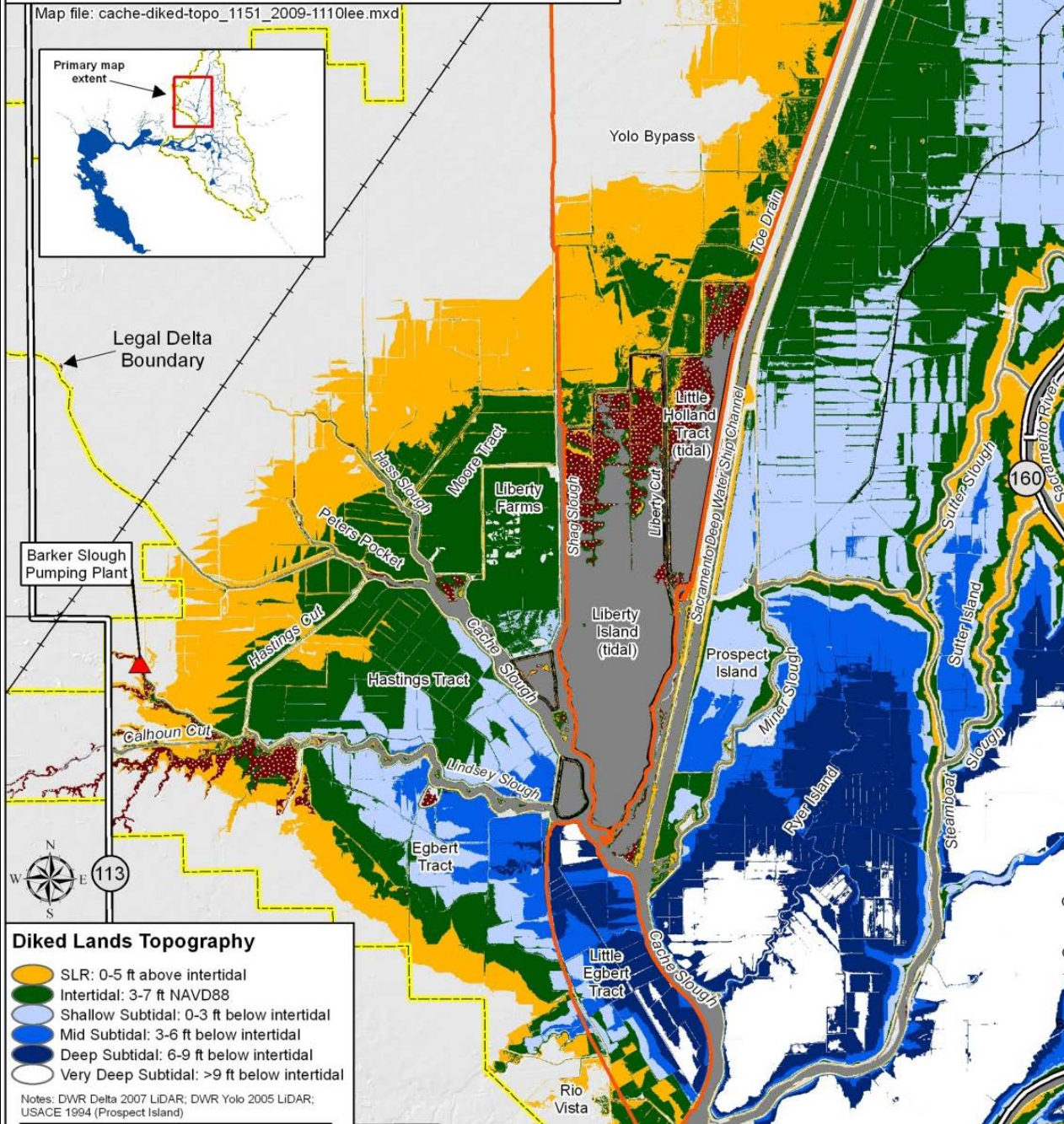
FRPA Near-term actions

- Planned and potential projects
- Additional future projects will be needed
- FRPA will support other programs where possible



Cache Slough Complex Diked Lands Existing Topography

Map file: cache-diked-topo_1151_2009-1110lee.mxd

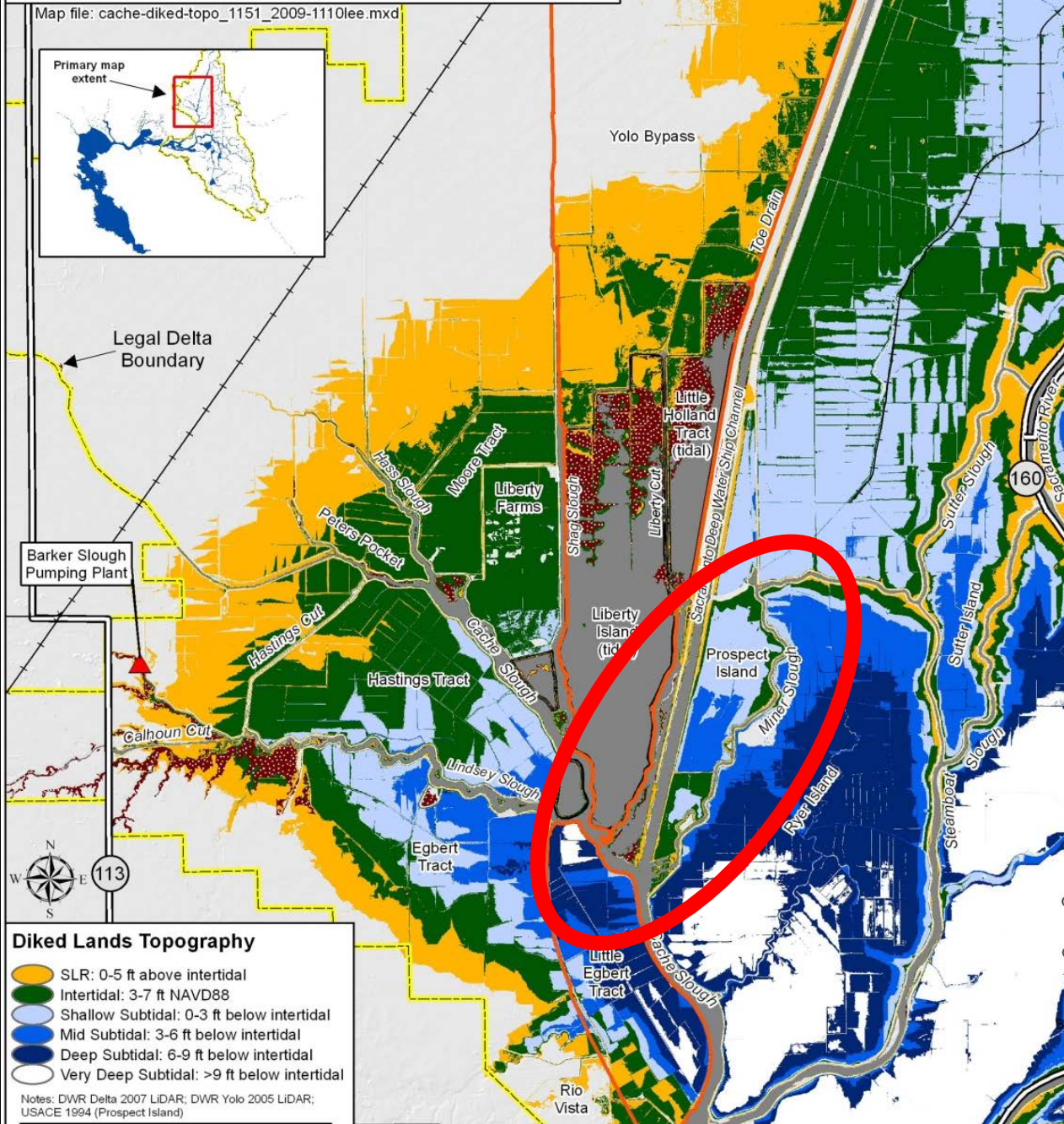


Diked Lands Topography

- SLR: 0-5 ft above intertidal
- Intertidal: 3-7 ft NAVD88
- Shallow Subtidal: 0-3 ft below intertidal
- Mid Subtidal: 3-6 ft below intertidal
- Deep Subtidal: 6-9 ft below intertidal
- Very Deep Subtidal: >9 ft below intertidal

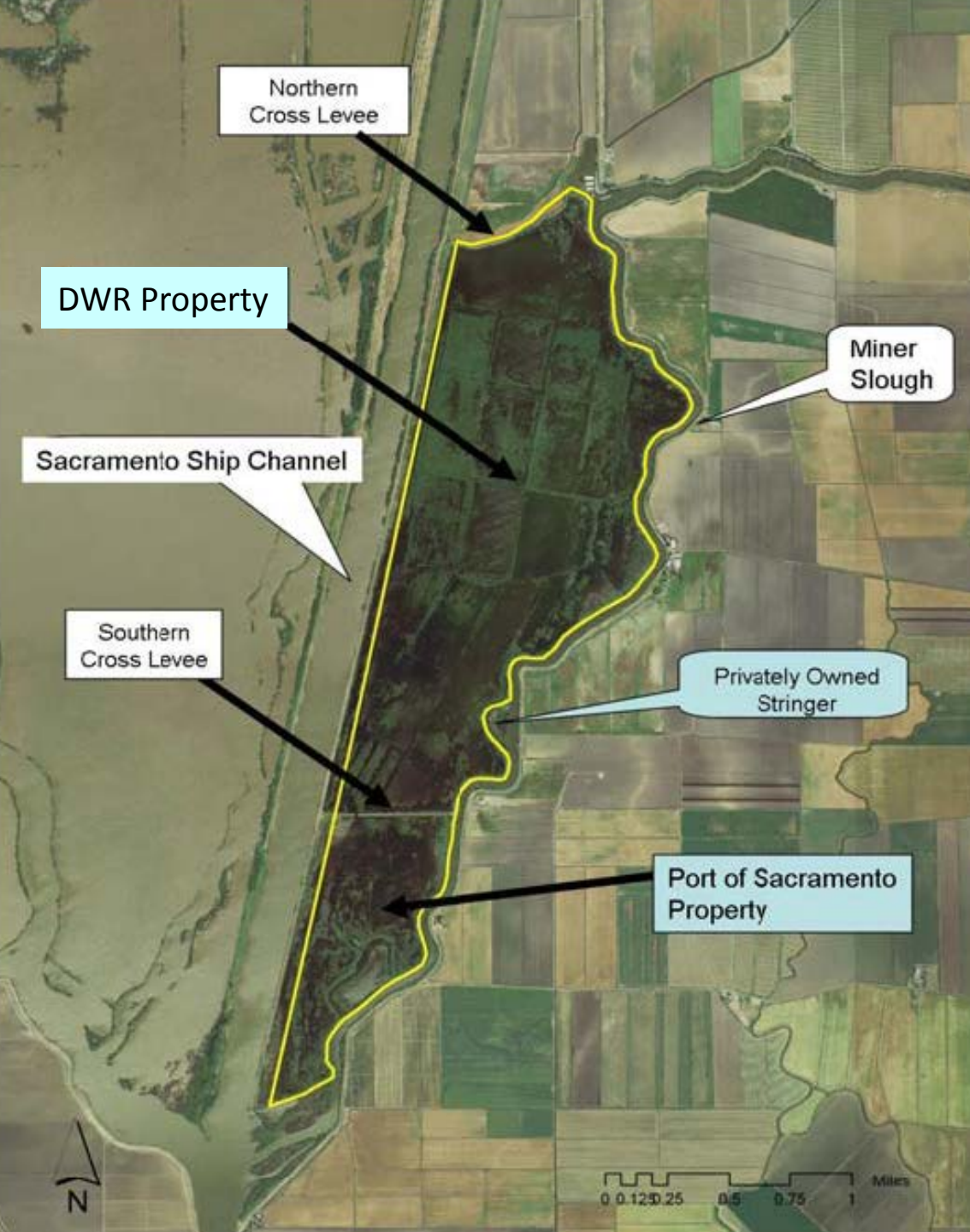
Notes: DWR Delta 2007 LIDAR; DWR Yolo 2005 LIDAR;
USACE 1994 (Prospect Island)

Cache Slough Complex Diked Lands Existing Topography



Prospect Island Restoration

- Historically farmed
- Currently diked marsh
- Northern 2/3 acquired by DWR in 2010
- Restore tidal habitat by breaching levees

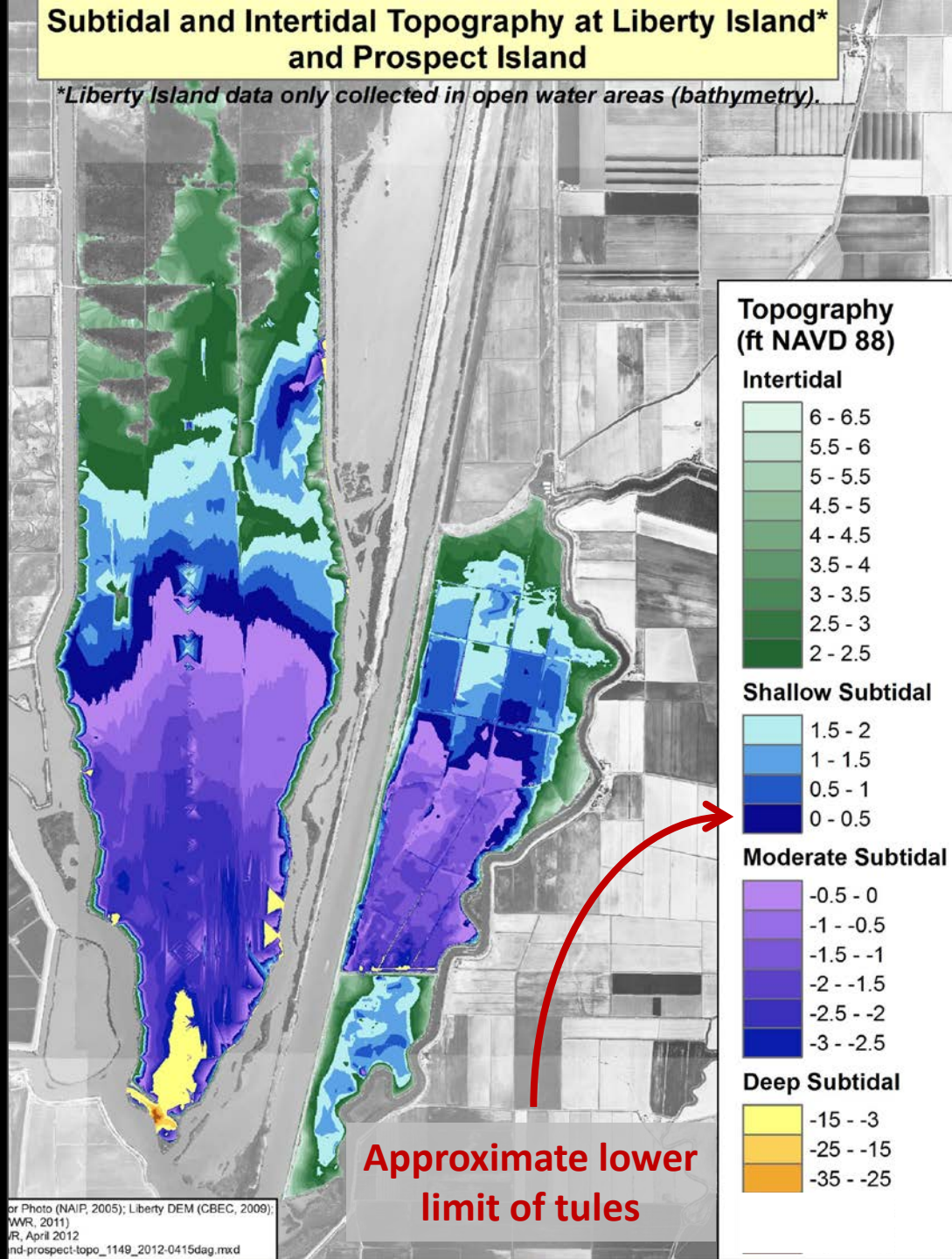


Prospect Island Existing 'Feral' Vegetation

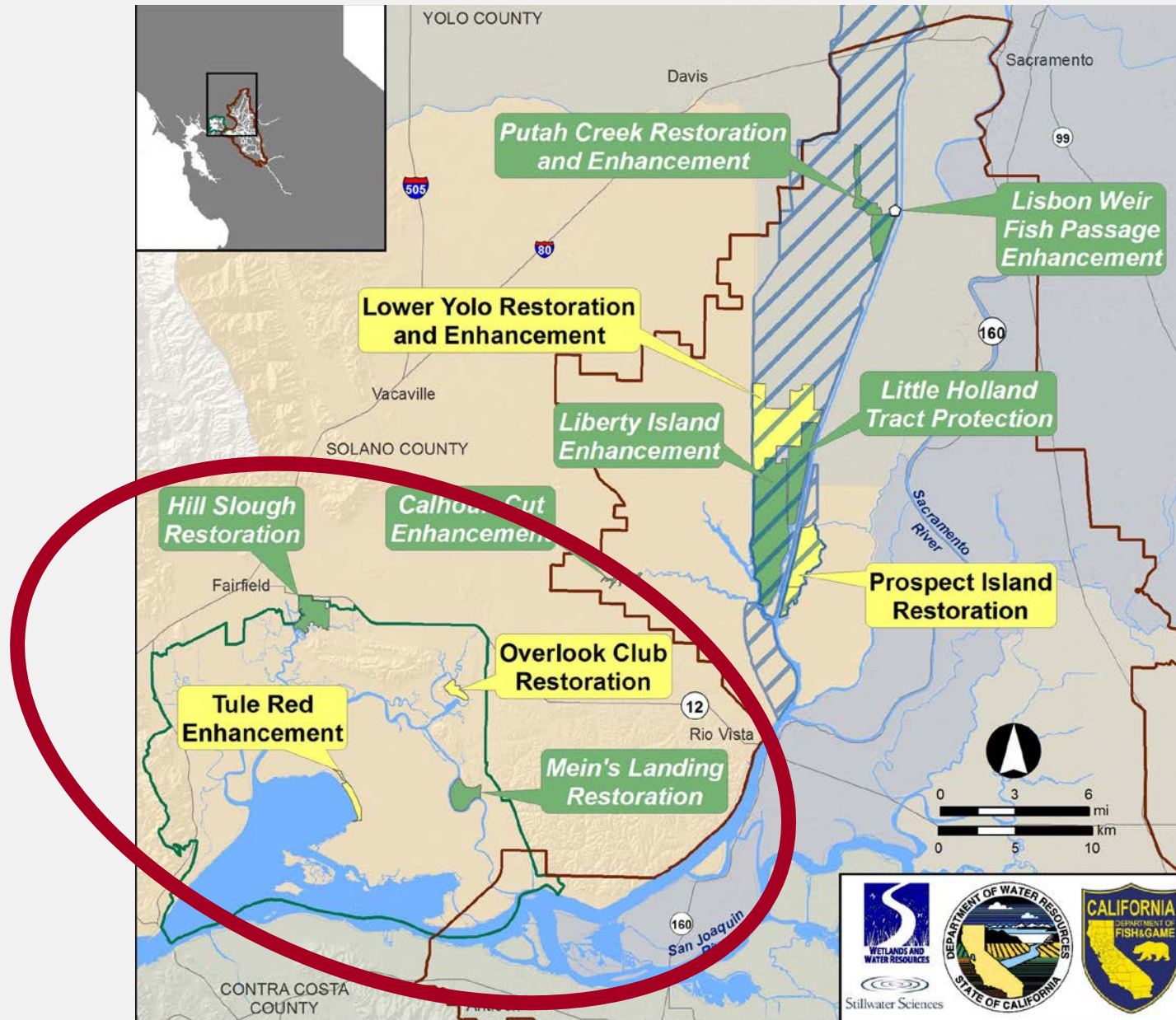


Subtidal and Intertidal Topography at Liberty Island* and Prospect Island

**Liberty Island data only collected in open water areas (bathymetry).*



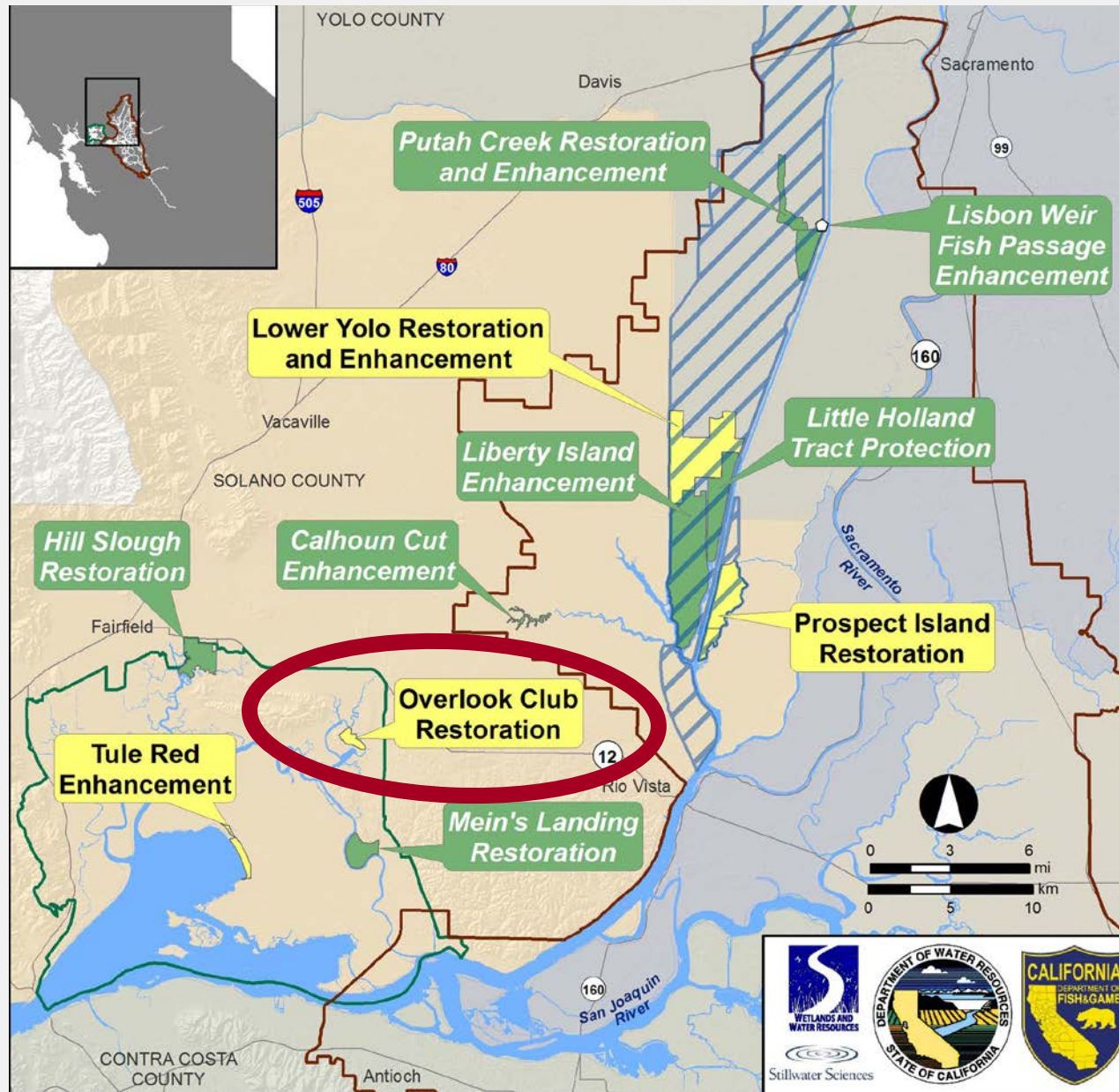
Suisun Marsh Restoration



Suisun Marsh Habitat Management, Preservation, and Restoration Plan

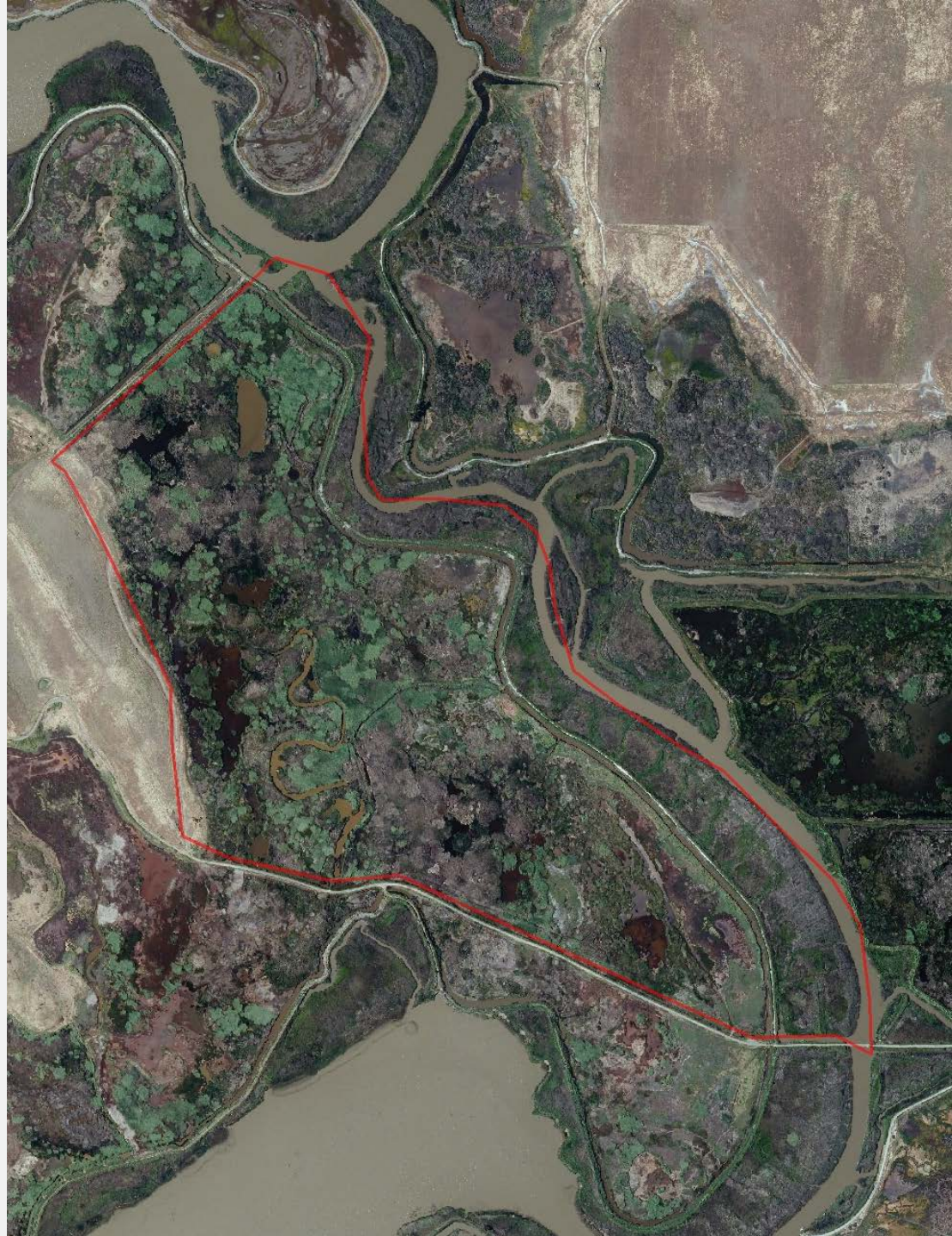
- Final EIS/EIR December 2011
- 30 year plan
- Balance needs of managed *and* tidal wetland-dependent species
- Help recovery of Threatened and Endangered species
- Restore up to 7,000 acres of habitat for tidal marsh-dependent species

Suisun Marsh Restoration

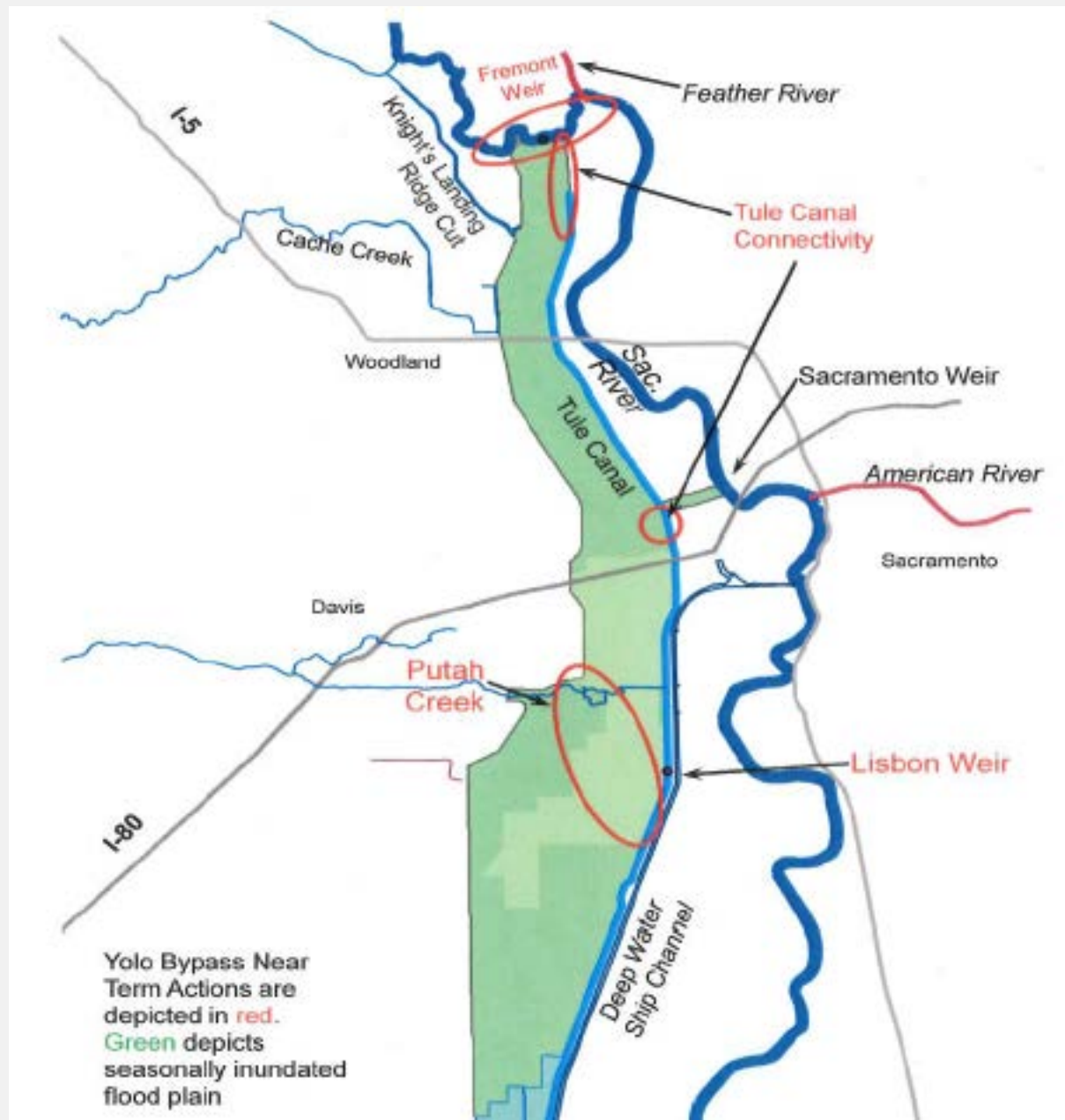


Overlook Club Restoration

- 245 acre property
- Currently diked for waterfowl
- High quality adjacent habitats
- High productivity and native fish abundance



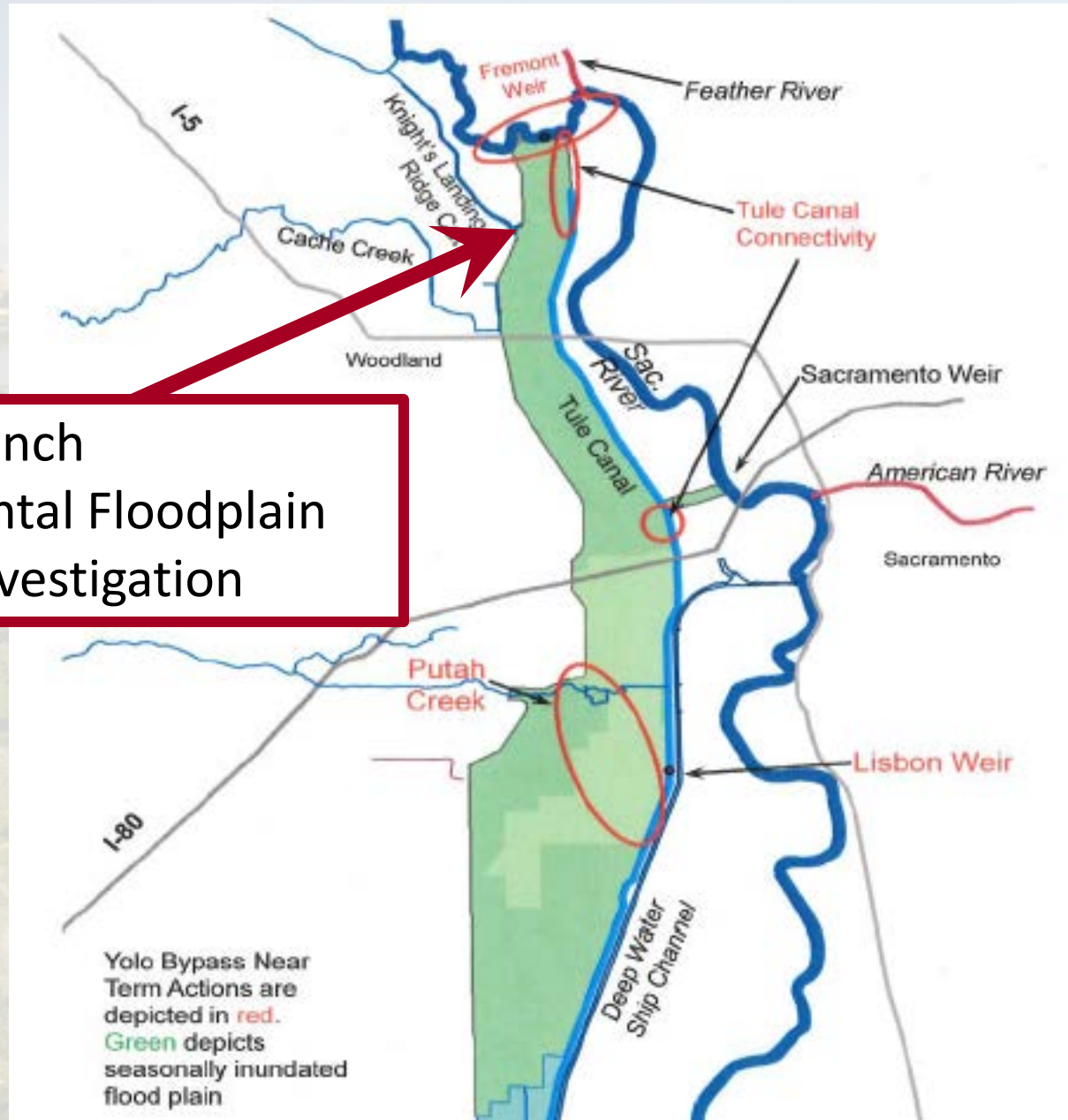
Yolo Bypass Restoration



Yolo Bypass Salmonid Habitat Restoration and Fish Passage Implementation Plan

- Joint effort between DWR and USBR
- Scoping begins Fall 2012
- Objectives
 - Increase access to seasonal floodplain
 - Reduce stranding
 - Increase primary and secondary productivity
 - Improve fish passage

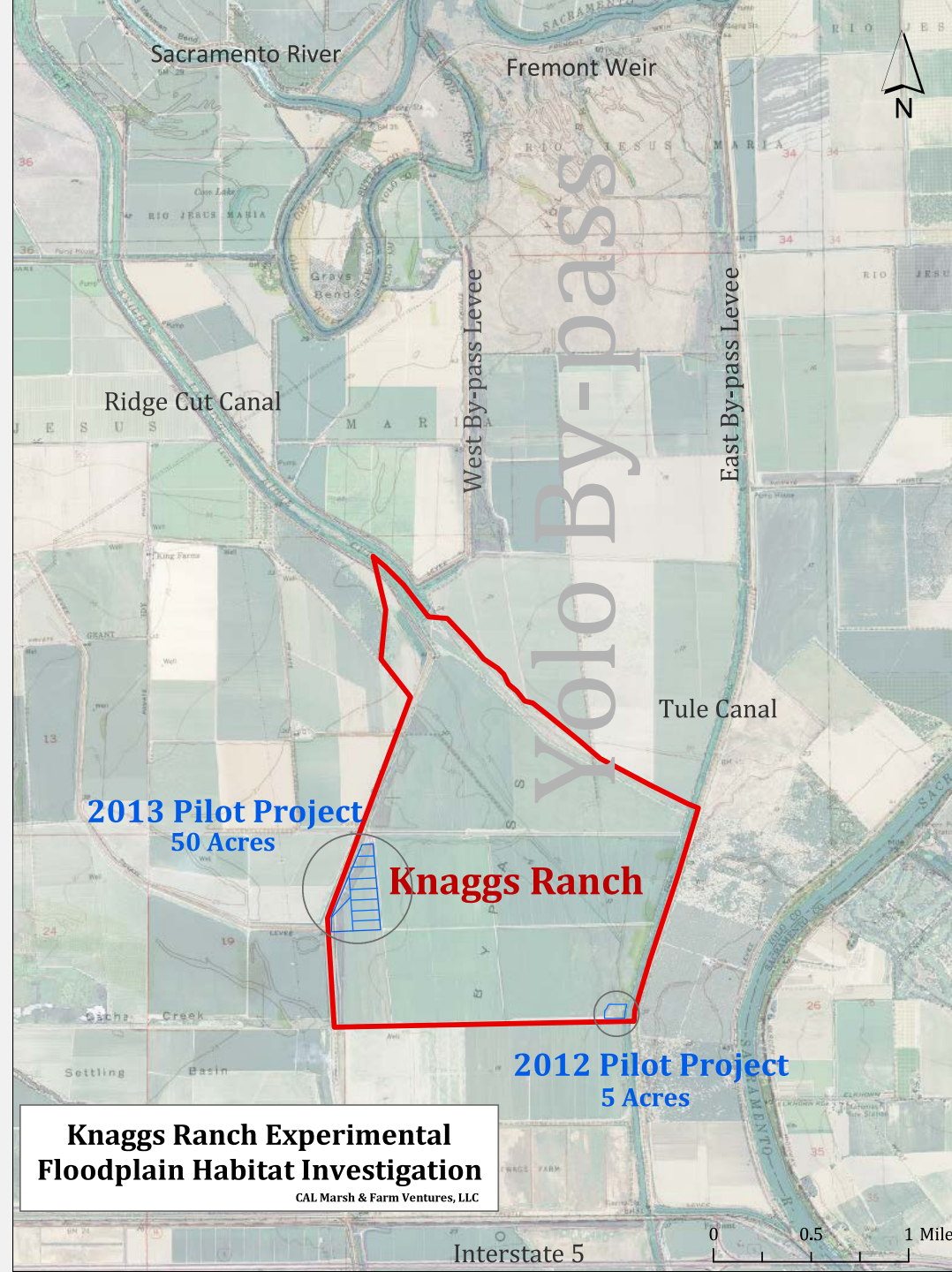
Yolo Bypass Restoration



Knaggs Ranch
Experimental Floodplain
Habitat Investigation

Knaggs Ranch Pilot Study

- DWR, UCD, and BOR
- Assess agricultural land as habitat for juvenile salmonids
- Winter 2012 pilot project, will expand for 2013
- Results will inform restoration Plan



Summary

- DWR habitat restoration efforts
- Restoration goals are focused on recovery of Delta native fish
- Objectives include habitat creation and food web production
- Monitoring and adaptive management is key